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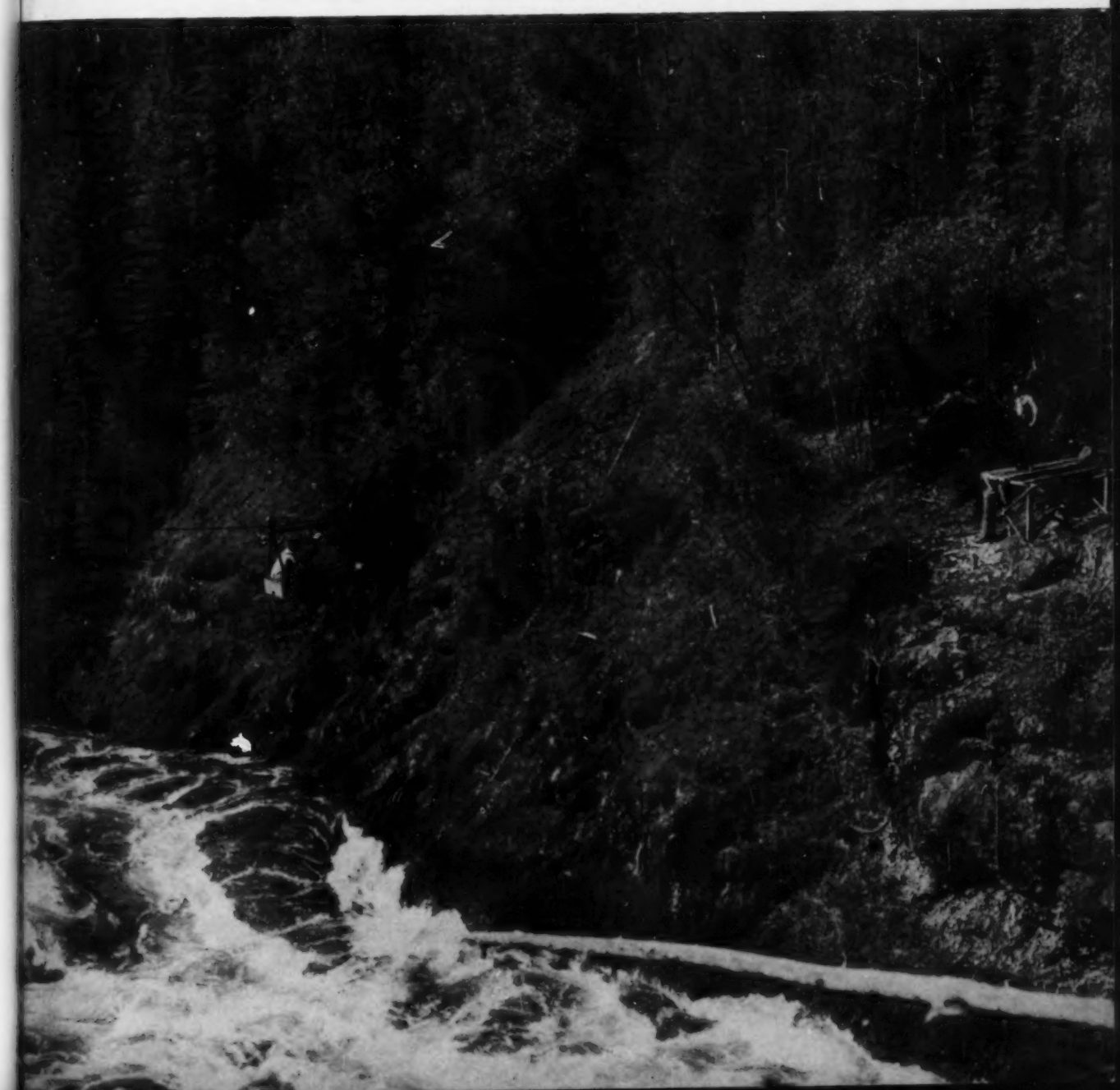

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Aluminum — The Story of Fifty Years of Growth by the Canadian Industry

by B. J. McGUIRE

THERE IS an interesting relation between the development of Canada's aluminum industry and the growth of Canada itself during the past half-century. When the long reign of Queen Victoria was drawing to a close, Canada was primarily an agricultural country with the fullness of her industrial development still before her. At that time, the aluminum industry was new in Canada and the metal was not widely known or used. In the past fifty years, while Canada has grown to nationhood and maturity, the Canadian aluminum industry has also grown to take its place among the most important of this country's enterprises. Few indeed were the people of half a century ago who dreamed of the great future which lay ahead of Canada or her young aluminum industry.

History of Aluminum

It is true, of course, that many of the characteristics of aluminum were known long before the Canadian industry was established. Almost a century earlier scientists had actually produced aluminum and discovered its unusual lightness and strength. Although one-eighth of the earth's crust is aluminum (making it the world's most abundant metal) nature had locked it so securely into the earth that scientists had to labour for decades to find a means of releasing it in large quantities for the world to use. So difficult and expensive were the early methods of obtaining aluminum that it remained for a long period a precious metal—too costly for general use. All this was changed in 1886 when twenty-two-year-old Charles Martin Hall of the United States and twenty-two-year-old Paul Louis Toussaint Heroult of France—working 3,000 miles apart and entirely unknown to each other — developed the same economical method of making aluminum from its ore.

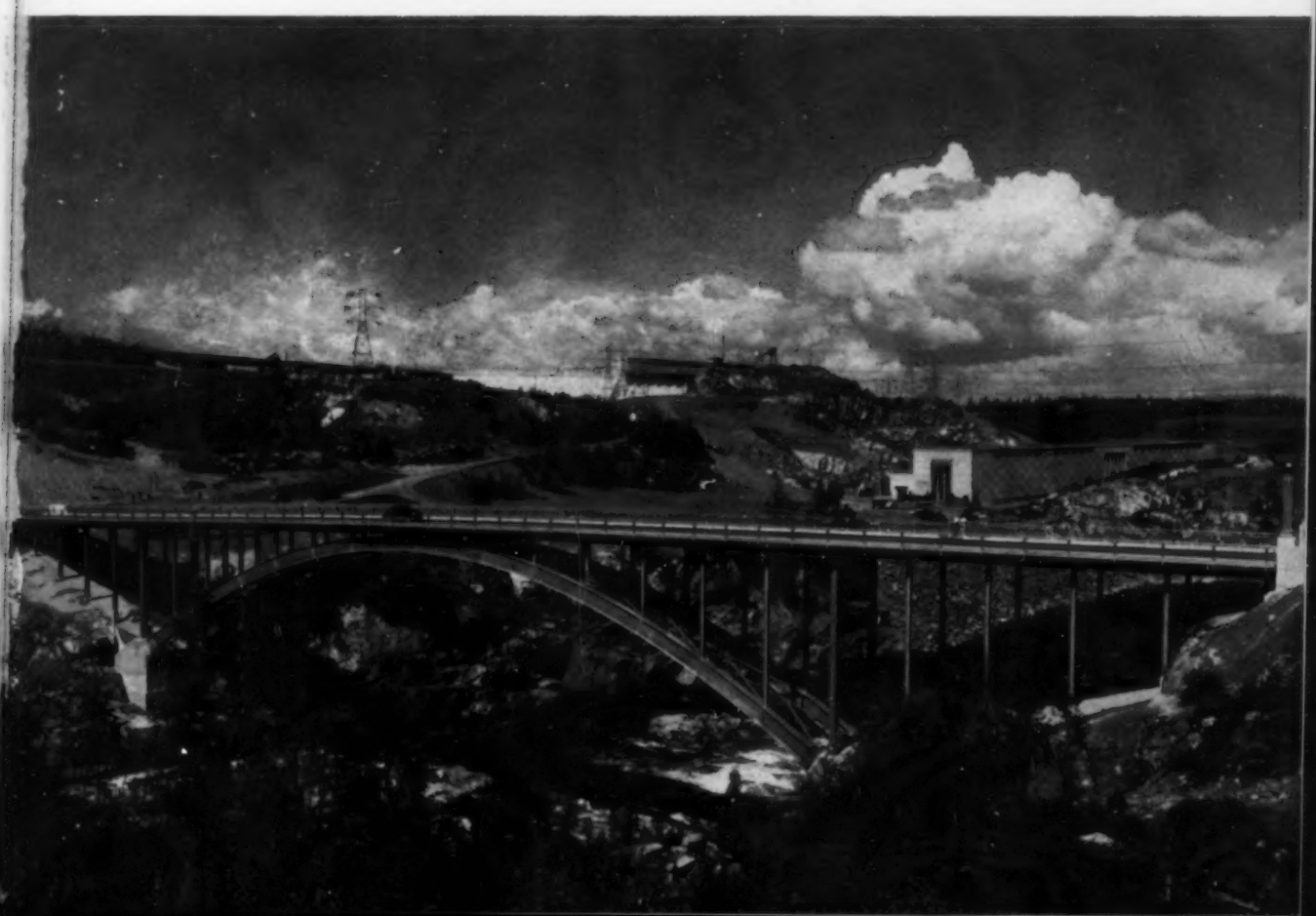
This discovery did not bring immediate success to the newly born aluminum industry. Like all ancient and modern industries, the infant aluminum enterprise encountered many obstacles. Among these are three problems which can never be finally solved.

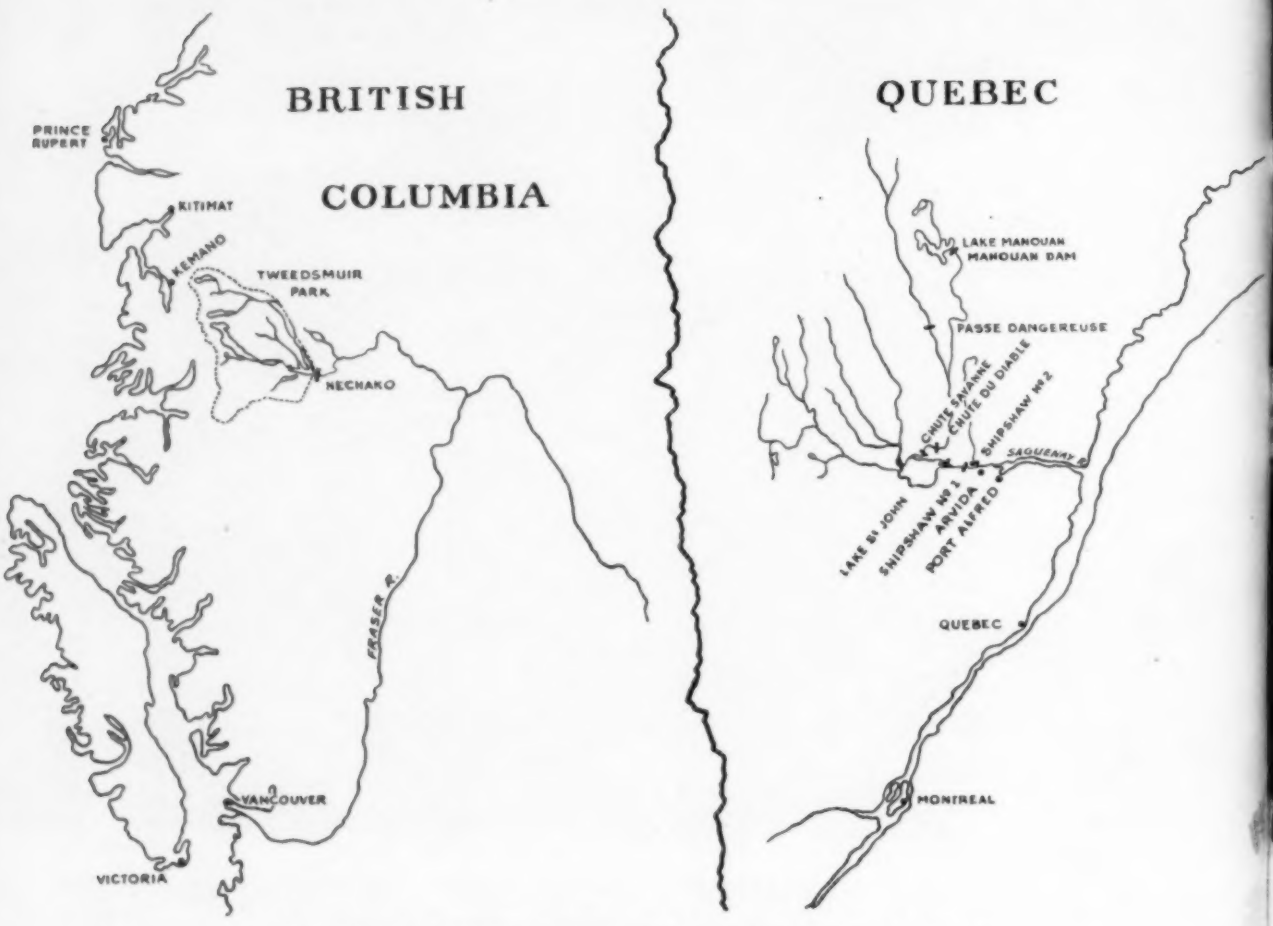
One subject of constant concern to the industry is the development of uses for the metal and of markets for it. For hundreds of years such basic materials as wood, steel, copper, tin, zinc and iron had been used for purposes aluminum might be expected to serve. Naturally, manufacturers were reluctant to experiment with this new metal. As a consequence, the research and sales departments of the industry undertook an endless twofold task: to develop and improve the alloys of the metal so that it could be used efficiently in as many ways as possible, and to prove—if necessary by actual practice—that it would work well. The success of this effort, which is being energetically continued, may be measured in the thousands of different uses of the metal today.

A second problem of the industry is to find places where conditions are suitable for making aluminum cheaply. There are not many places in the world where geography and climate combine to produce the conditions necessary for the establishment of a large aluminum industry. The process now employed for extracting aluminum from bauxite (the ore of aluminum) requires tremendous amounts of electrical power. The electricity needed to make one ton would light the average home for fifteen years. Over the years it has been established that the most economical way of producing electricity is by the use of water power. Bauxite can be mined with shovels and shipped easily on boats or trains; but electricity must be used near its source. As a consequence, any large aluminum industry must be located near the source of an abundant quantity of low-cost hydro-electric power. To take ad-

Right:—In this research laboratory at Kingston, Ontario, scientists and technicians are ever seeking better and more economical ways of producing and fabricating aluminum.

Below:—The world's first all-aluminum highway bridge spans the Saguenay River at Arvida, Que. This is an outstanding example of the application of aluminum as a structural material.





Locations of aluminum developments on west and east coasts. In British Columbia Kemano is the site of the future power house, Kitimat the site at tidewater of the smelter and townsite.

Shawinigan Falls, Quebec, at the time construction of the first Canadian smelter started in 1900. From that time the city's industrial growth has been rapid.

The large Shawinigan Water & Power Company generating station at Shawinigan Falls, as it looks from the air today. The city, part of which may be seen in the left background, is now the hub of one of Canada's most important industrial areas.

vantage of the opportunities offered by a steadily growing market, the aluminum industry has always employed its experience and its skilled personnel in exploring for new operating locations for future needs, and in research for better and better methods of smelting and processing metal for the market.

The third and ever-present question of any successful enterprise is: How cheaply can the product be made? Unique though aluminum is in its ratio of lightness to strength (strong as mild steel and one-third the weight); in its ability to resist rust and other forms of corrosion; and in its many other characteristics, it must at all times meet competition from many sources. In the business world manufacturers are forced at all times to consider the cost of their raw materials and to use only those which are most effective at least cost. Aluminum must constantly meet this price test. The aluminum industry—as all other industries—works ceaselessly to reduce the cost of the product so that more people can and will buy it. The discovery made by Hall and Heroult did not end, but rather stimulated, the search for further economy in the production and manufacture of aluminum. The steady decline in the selling price of aluminum as production has increased proves the success of this effort.

The problem of competition and price has always been a determining factor in the location of aluminum-producing plants in Canada. Since electrical power is used in such large quantities (about 10 kilowatt hours are required for each pound of metal)

This huge smelter at Arvida, Quebec, is the largest of the four aluminum reduction plants. It covers an area one-and-a-half miles long by three-quarters of a mile wide.

Before it attained its present size, as shown above, this is how the Arvida smelter looked from the air in 1927.

the cost of this power is of first importance. Several conditions must be present before power can be produced economically. There must be a large volume of falling or running water which can be harnessed so that this natural force can be used to turn the generators. It is essential, also, that this power be free from demands of other large consumers which would limit the supply available for smelting aluminum and would, at the same time, increase the cost of it.

It was potential power that first led the aluminum industry into the St. Maurice Valley at the turn of the century. The St. Maurice River, dropping more than 1,300 feet in a series of cascades and falls over its 240-mile length, offered favourable conditions for the development of hydro-electric power. On the St. Maurice, thirty miles above Three Rivers, beside the forest-surrounded falls of Shawinigan, the first Canadian plant was built to produce aluminum

Home for many of the aluminum workers in the Saguenay Valley is the city of Arvida, with a population of over 11,000 persons. This city is regarded as one of the best planned in North America.

The 1,500,000 h.p. Shipshaw development on the Saguenay River. Its power is used for aluminum production at nearby Arvida. At the left is the world's first all-aluminum highway bridge.

in 1900. Here also was developed the wire and cable factory which has, over the years, provided a large proportion of the transmission lines which carry electrical current not only in Canada but in many parts of the world.

The presence of hydro-electric power, which first attracted the aluminum industry to the St. Maurice Valley, also attracted many other industries. Within a quarter of a century the demand for the metal had so increased that the St. Maurice could no longer supply the needs of this industry and, at the same time, satisfy the demands of other industries which were moving into the area. It became necessary then to find another location suitable for the production of the metal which required so much power. This search led to the Saguenay Valley, 400 miles northeast of Montreal. Although it had long been a trading route, and was settled in 1820-50, the Valley remained remote

Bauxite, a reddish brown clay, is the basic ore of aluminum. It is found under layers of top soil in tropical and sub-tropical countries. Here it is being mined in British Guiana.

and difficult of access, while its only products came from its forests and farms.

The history of the aluminum industry in all countries is a story of pioneering work in the wilderness to develop the hydro-electric power needed. Then, when the existence of economic power has attracted other industries, the aluminum business expands to another primitive area to develop power sources anew. This has happened in Canada, the industry expanding first from Shawinigan Falls to the Saguenay, and now to the British Columbia coast.

The Saguenay River drops more than 300 feet between Lake St. John and tidewater thirty miles downstream. In 1925 a 540,000-horsepower capacity plant was established on the river near Lake St. John. This, together with the favourable factors for additional power farther down the river, justified the move to the Saguenay.

Transportation of Raw Materials

Several other circumstances made the Saguenay Valley a favourable site for the growing aluminum industry. The Saguenay River is a study in contrasts. In its thirty-mile course from Lake St. John to tidewater it is a plunging, rushing torrent, ideal for the development of power. For the remaining sixty miles to its junction with the St. Lawrence it is a deep, mountain-flanked, quiet waterway, offering ideal navigation conditions during the ice-free period of the year. This situation permits ocean-going ships, coming and going from the seaports of the world, to dock within twenty miles of the selected plant site at Arvida. Such accommodation is important to this great Canadian industry because—with the exception of electricity which must be generated where favourable geographic and climatic conditions permit—almost everything used in the smelting of aluminum comes from outside the country's borders.

Up this water route comes the bauxite ore, obtained from the Demerara Bauxite Company Limited, 3,000 miles away. This is a mining subsidiary of the Aluminum Company of Canada Limited in the sub-tropical country of British Guiana on the northeast

Helicopters fly men and materials into the more remote spots of the British Columbia aluminum development.

coast of South America. Although aluminum ores are found all over the world, commercial-grade bauxite is mined only in areas adjacent to the tropics. These bauxite deposits, found up to sixty feet beneath the thick jungle vegetation, are mined inland beside the Demerara River. Ocean-going steamers can load the ore from the company's docks at the model community of Mackenzie. From there they can steam directly to Port Alfred, where the company has built large wharfs within twenty miles of Arvida. A company-owned railway then takes the bauxite from the steamers directly to the plant.

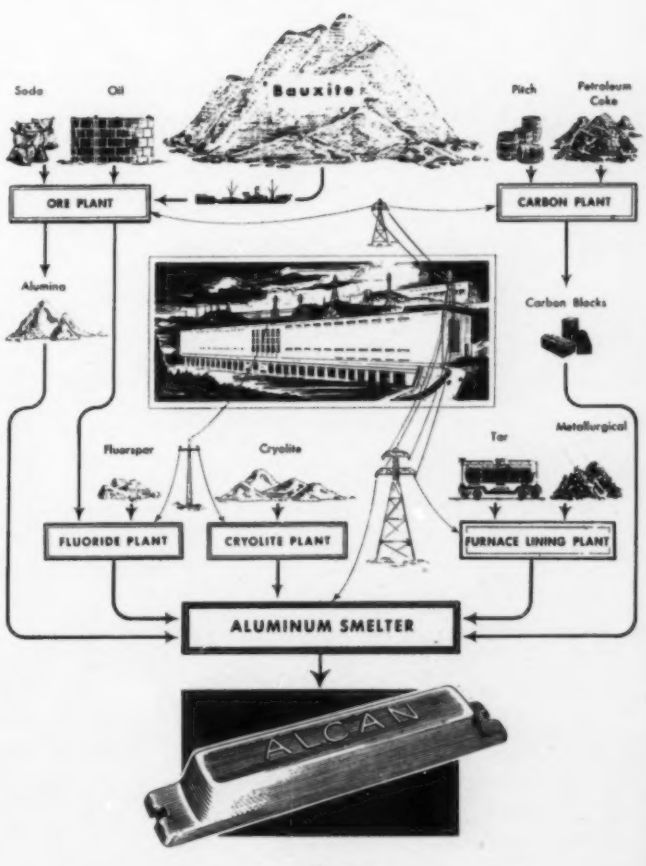
Petroleum coke, another essential in the manufacture of aluminum, is obtained in Texas, and is also shipped to Port Alfred from ports on the Gulf of Mexico. Cryolite, the third essential raw material in smelting aluminum, is mined only in Greenland; so it, too, is easily shipped to Arvida. Fluorspar is shipped from Newfoundland. These transportation facilities are important also in moving metal from the plant. The Aluminum Company has made a special effort to develop export markets and now sells some 85 per cent of its output abroad. International trading permits economical large-volume production of aluminum which, in turn, lowers the price of ingot to Canadian customers.

How Aluminum is Made

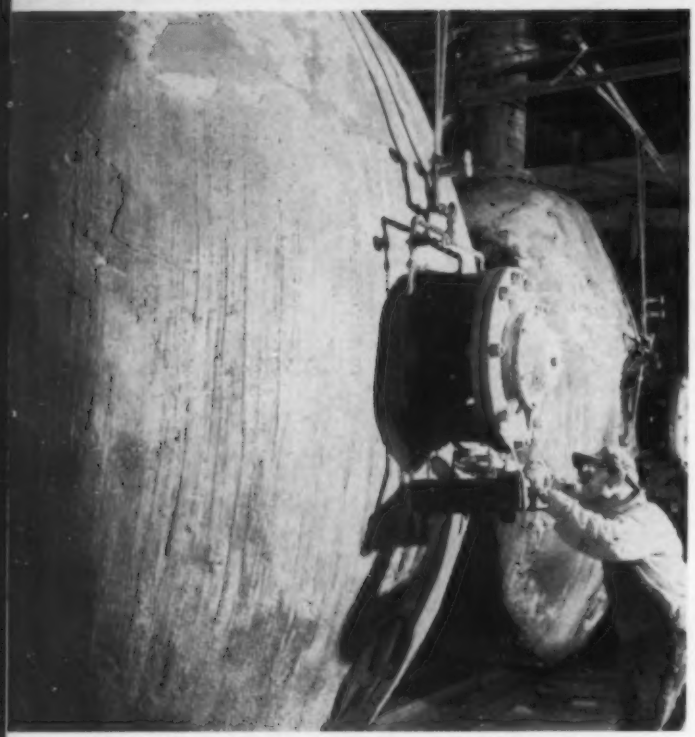
The technique used in making aluminum today is, in many ways, similar to that employed when the industry was launched in Canada half a century ago. Though methods have been improved, the process still begins with the separation of alumina from the bauxite. The reddish-brown ore is washed and then treated in a soda solution to yield a chalky-white powder containing a high concentration of aluminum. This material, alumina, is fed into a reduction furnace, or "pot", where it dissolves in a bath of molten cryolite to which aluminum fluoride has been added. The reduction furnace (about ten feet wide by sixteen feet long, and usually made of steel) is lined with a paste of coke which is baked until hard. Electricity enters the furnace by travelling through the transmission lines and bus bar to another carbon block which is suspended in the molten cryolite. As the electricity flows from the carbon block through the cryolite to the carbon on the outside of the furnace it provides the necessary action to separate the alumina into aluminum and oxygen, and the red-hot metal sinks to the bottom of the pot. The metal is then drained out of the pot and poured into solid, rectangular shapes called ingots, which may reach 1,000 pounds each in weight. In the Arvida plant there are 2,500 such aluminum-producing pots.

This brief and greatly simplified description of the process suggests the tremendous amount of work involved in the production of each pound of metal. Assembling raw materials—bauxite, fluorspar and petroleum coke—at a point where power is available

THE ALUMINUM INGOT



It takes about 7 tons of raw materials, plus electrical energy equivalent to 16 tons of coal, to make 1 ton of aluminum.



Top:—After the bauxite ore is crushed to powder it is fed into mixers with a solution of caustic soda. This mixture is then charged into huge digestors where the alumina dissolves and goes into solution.

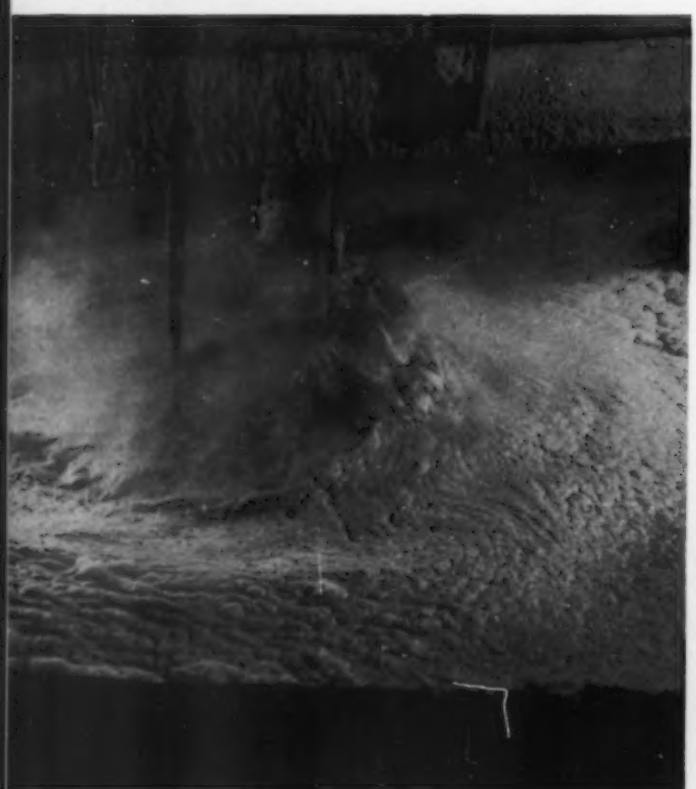
Below:—After the alumina has been separated from the impurities the liquid is cooled and agitated by compressed air in precipitator tanks like this one which stands over five storeys tall.

Lower right:—An electrolytic process reduces the powdery alumina to gleaming aluminum which is then poured into moulds where it solidifies into ingots weighing about 50 pounds each.

is a task requiring a large organization of men, money and materials. The production of this power is, in itself, a major enterprise. Increased capacity is being added. There are now on the Saguenay River the machines and equipment to produce 2,000,000 horsepower, almost one-sixth of all the power available in Canada. The handling of the coke for lining the pots and the manufacture of carbon blocks is also a large operation. The mining of bauxite, too, is a major enterprise, as is the mining of fluorspar at the company-owned and -operated mines in the new Canadian province of Newfoundland. All these materials must be obtained and assembled where smelters operate. It follows, therefore, that transportation is not only a large but also a costly phase in the making of aluminum. To this preliminary expense must be added the cost of making metal out of the raw materials, this process requiring huge plants, much manpower and additional money.

The Saguenay Valley

When the aluminum industry moved into the St. Maurice Valley in 1900, it was a



relatively small enterprise and such matters as housing and education were not pressing problems as the city grew around the plant. This was not the case in the Saguenay Valley a quarter-century later. By that time the industry had grown considerably. Thousands of men were required for the enterprise and accommodation was needed for them. This was provided by the building of a complete city, Arvida, carefully planned to the last detail and equipped with recreation centre, hospital, shops, schools and churches and other facilities. Arvida has become one of Canada's most attractive communities, while the Saguenay Valley has developed into one of the most important aluminum-producing centres of the world, with smelters at Ile Maligne and Arvida. These, together with smelters at Beauharnois and Shawinigan Falls, produce more than twenty-five per cent of the world's aluminum.

The Saguenay Valley has the capacity to produce more than 750,000,000 pounds, or 350,000 tons, of aluminum annually. The amount of basic raw materials necessary for the production of this metal is staggering: about seven tons of raw materials—including four tons of bauxite—for each ton of aluminum. To feed the Canadian smelters to capacity, 500 boxcar loads a day of raw materials must be brought together from points in the world thousands of miles away. The cost and effort of bringing materials to this centre in Canada where they can be made useful to man is fabulous.

At peak capacity more than 7,000 people are employed in the production of aluminum in the Saguenay Valley alone. The cost of wages, retirement benefits and other expenses for these men runs into tremendous amounts annually. The cost of the buildings, land, power-houses and machinery for the operation represents more than $400,000,000. Taxes paid in Canada and abroad in 1950 exceeded $28,000,000.

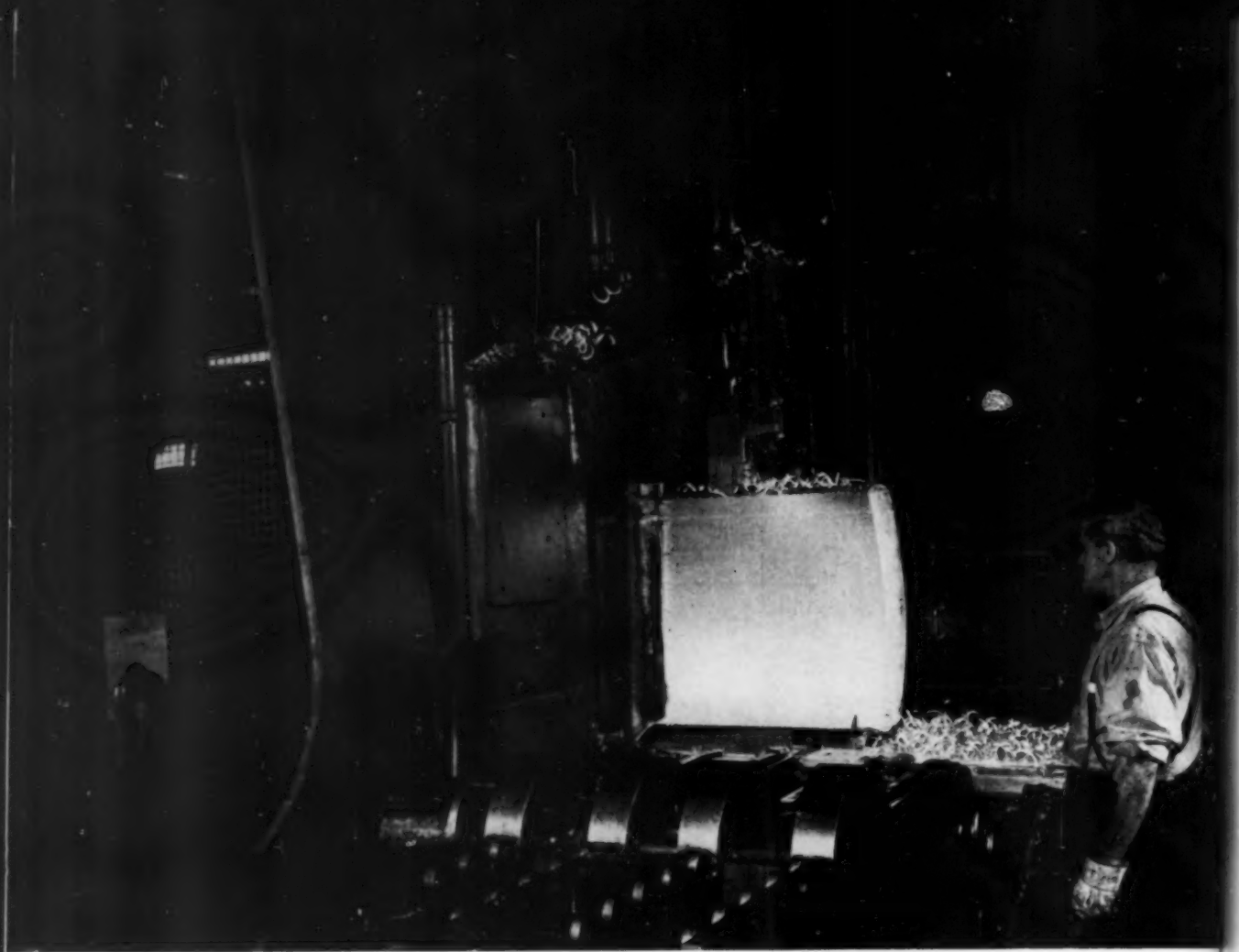
The Saguenay Valley has not yet reached the limit of its capacity to produce aluminum. In 1942 the Shipshaw power development, one of the largest undertakings of its kind, went into operation a few miles from Arvida bringing the installed capacity of the Saguenay Valley to 2,000,000 horsepower. At the present time construction is under way on two projects on the Peribonka River which runs into Lake St. John, which in turn feeds the Saguenay. These projects will add another 500,000 horsepower to the installed capacity of the 30,000-square-mile watershed and this additional electricity will increase the power available for the district and for the production of aluminum.

Because of the tremendous totals of men, money and materials all these operations require, the modern aluminum company must be a big company. The cost of the Saguenay project, which actually is only one of the operations of the Aluminum Company of Canada, is borne by thousands of shareholders. The essential fact, however, is that an aluminum industry must be in a position to undertake tremendous expenditures on large-scale operations.

Fabrication of Aluminum

The gleaming metal which comes from the pot lines in ingot form still has a long

An ingot of aluminum being put into a remelt furnace. Here it is alloyed with other metals and repoured into shapes such as the sheet rolling ingot shown in the following photographs.



On this automatic scalping lathe the rough cast surface of the sheet rolling ingot is removed before the ingot is pre-heated for rolling.

The rolling ingot is then pre-heated in soaking pits like this one. Conveyors then deliver the sheet metal to the rolling mill.

Aluminum slab is produced by passing the pre-heated ingot back and forth between the rolls of the hot mill. This reduces its thickness with a corresponding increase in length with each successive pass through the rolls.

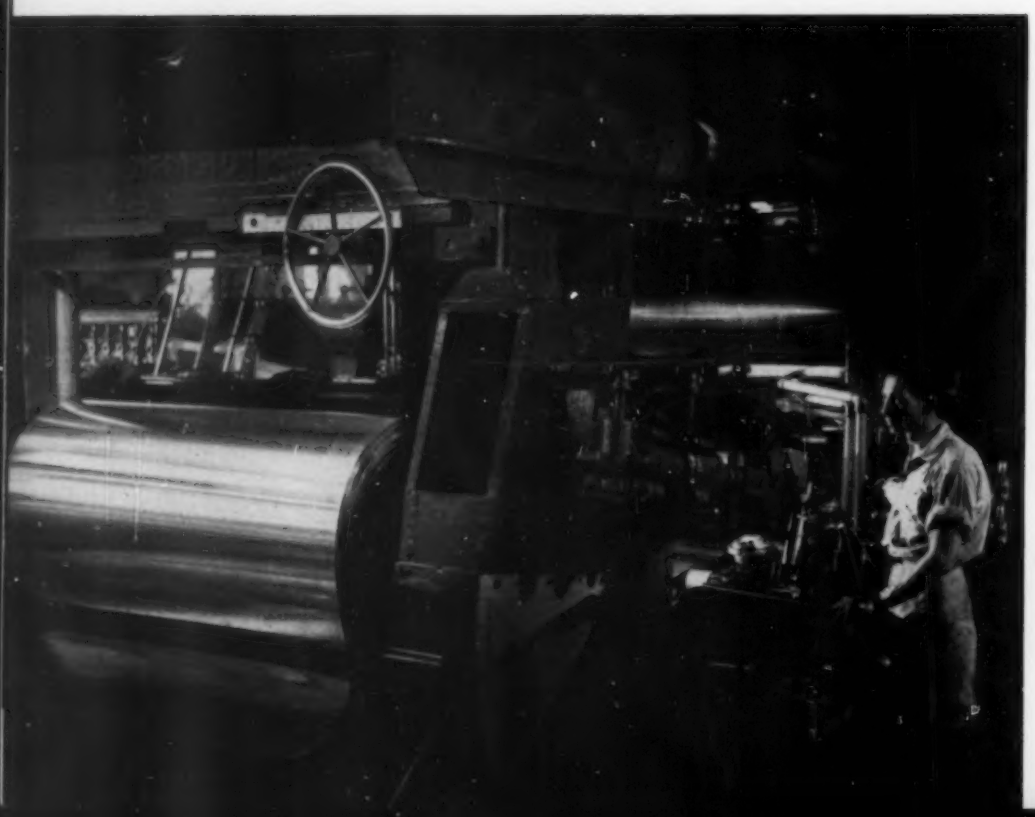
way to go before it can be useful to the consumer. Indeed, from this point the manufacture of aluminum entails a vast number of processes. Because of its basic characteristics, aluminum can be rolled, spun, drawn, extruded, forged, cast or powdered. Almost all of these operations, in one form or another, are conducted by the company in its various Canadian plants. Large though these fabricating plants are, however, they use only a small fraction of the total output of the producing plants; most of the aluminum produced in Canada is sold to other countries.

Aluminum owes much of its success in the world today to the new alloys which have been developed by research scientists and engineers. It is an ancient practice to mix with a given metal certain small quantities of other materials which will change the nature of the original. This process affects the strength, hardness and other properties of aluminum. The metallurgist's science has thus made it possible to produce several hundred alloys of aluminum, all with different characteristics. A common example of the change made in aluminum by alloying is the way in which its strength can be increased. Pure aluminum is a soft metal. A one-inch test bar of the metal in its pure state will break under a load of about 15,000 pounds. Certain types of alloys of aluminum can be made so strong that a one-inch test bar will lift a load in excess of 80,000 pounds. Thus, it is possible to produce different alloys ranging widely in strength.

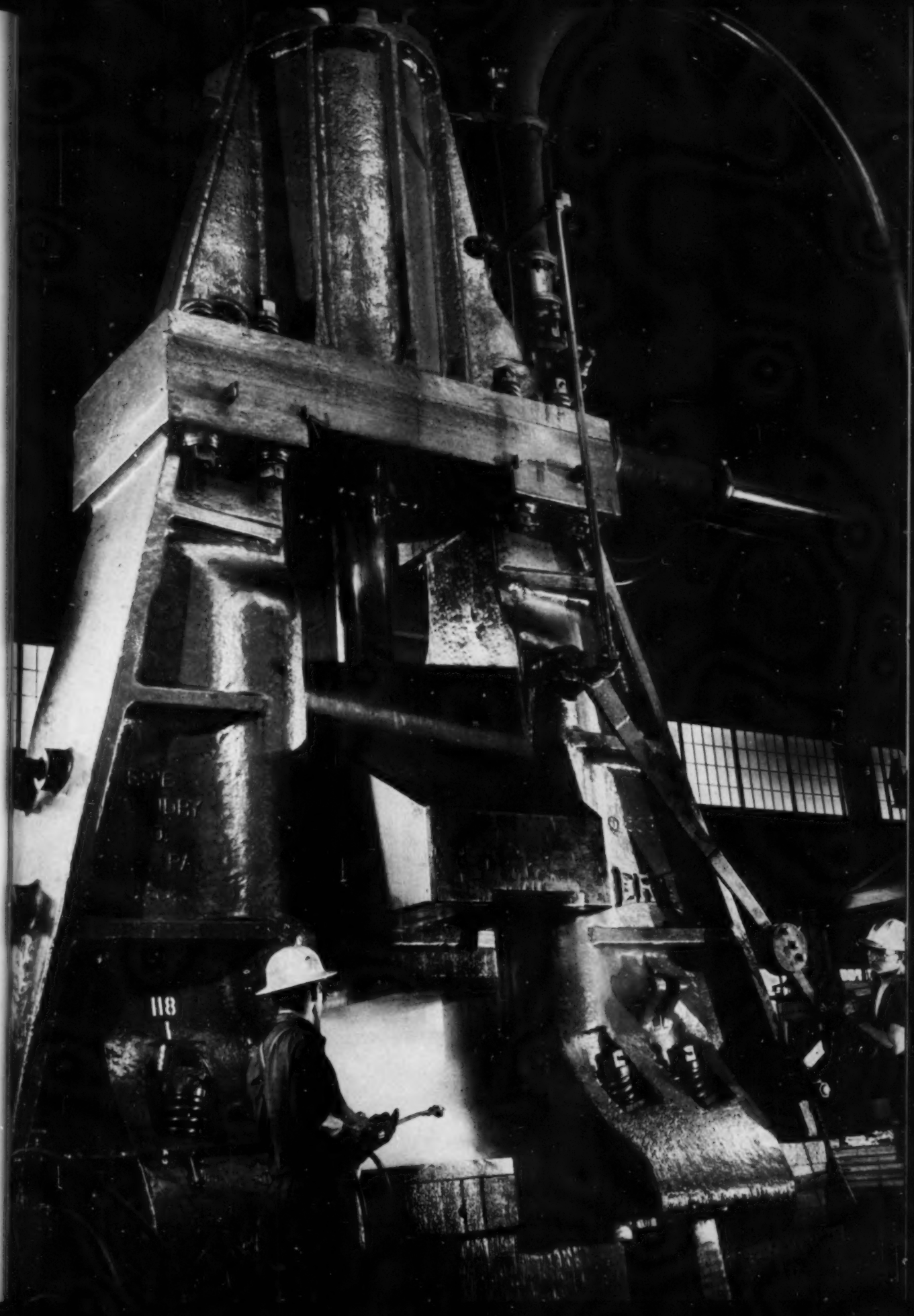
Following the operations of the company westward from the Saguenay Valley, we find the first stop is at Shawinigan Falls, the home of the first aluminum plant in Canada. Within the past ten years a new production plant has been built at Shawinigan and the original one has been converted almost exclusively into a wire plant. Here pure metal, which is the best conductor of electricity, in the form of rod from the modern Arvida rod mill, is drawn into wire and laced around a steel core to produce the world-famous ACSR — aluminum cable steel reinforced. The conductivity, resistance to corrosion and lightness of aluminum make it an ideal material for transmission lines carrying electricity. Aluminum cable is one of the best of known conductors, while the lightness of the metal results in worthwhile savings because the towers carrying the cables can be spaced farther apart, so that fewer are re-

As the sheet becomes longer and longer, it runs backwards and forwards along the roller table.

Below: After cooling, the hot mill slab is cold rolled and finished as flat sheet or coiled as in this photo.



Right: One of the most spectacular of all the many methods for fabricating aluminum is forging. Here, at Kingston, Ontario, light alloy forgings, ranging from the smallest size to those of a hundred pounds or more, take form under the relentless pounding of giant hammers.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Rolls of coiled sheet aluminum ready for shipment from the fabricating plant. Right:—Flat sheet is carefully inspected before delivery to the customer.

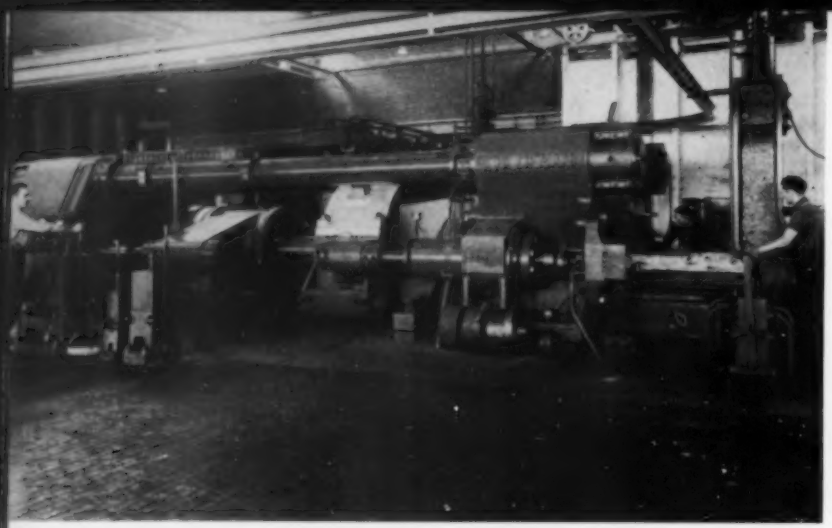
quired. The great usefulness of aluminum for this purpose is shown best, perhaps, by the fact that more than 5,000,000 miles of it are in use around the world.

Near the western borders of Quebec, close to the power installations of Beauharnois on the St. Lawrence River, is a fourth aluminum smelter. This plant, constructed during World War II, remained idle in the first few post-war years. In 1951, when power became available at Beauharnois, it was again put into operation to meet increasing world demand.

One hundred and seventy-five miles west, where Lake Ontario empties into the St. Lawrence River, is the company's largest Canadian fabricating unit at Kingston, Ontario. The basic purpose of all fabrication is to convert ingots into shapes and forms that manufacturers can use. Much of this is done in Kingston by rolling, extruding or forging. One of the most important operations here is the sheet mill in which a flat slab of ingot, heated to the right temperature, is squeezed between a series of heavy rollers, under tremendous pressure, until it becomes a long sheet of metal. In this operation the final size and thickness of the sheet is determined by the purpose for which it is to be used. It may be a quarter of an inch thick or, if it goes through the foil-making process, it may be rolled down to the thinness of cigarette paper.

Part of this plant is devoted to the production of extrusions, a process in which the metal is forced through dies to take a desired shape, such as seamless tubing, angles, bars, channels or other designs. Another part of the Kingston operation is forging, a process in which the metal is literally hammered into dies under terrific pressure to take the desired shapes, which are cut into the dies themselves. During the last war propeller blades for aircraft were produced here by the thousands by this process.

Still farther west, at Etobicoke on the outskirts of the city of Toronto, the company operates a casting plant. Several methods can be used in casting and the particular one used depends upon such considerations as the number required, the difficulty of the design and the required strength of the product. The age-old art of the foundry is practised here. Molten aluminum is cast into patterns formed in sand and left to harden in the exact shape of the sand pattern. Another form of casting is that



Left: Aluminum may be extruded into long lengths of many varied shapes on extrusion presses.

Right: In spinning this aluminum milk pail, the operator, with a hand tool, forces the rapidly revolving sheet disk onto the form which is in the shape of the completed pail.

Far right: An excellent conductor of electricity, aluminum is widely used for power cable (A.C.S.R.). In Shawinigan Falls, aluminum wire is stranded around a steel core.

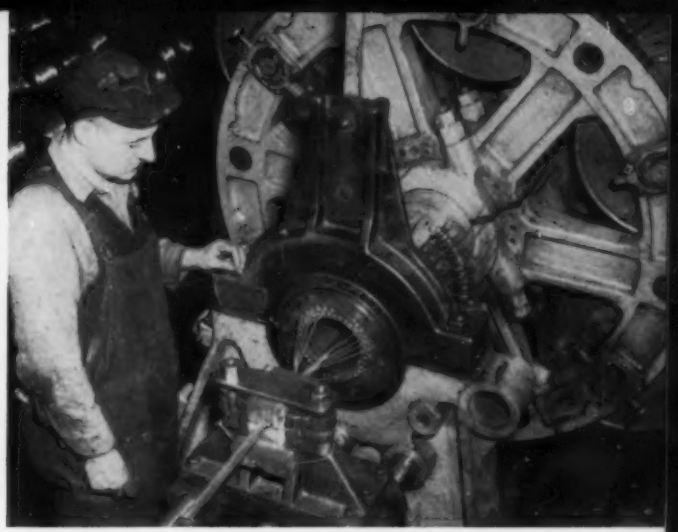
of pouring the molten aluminum into metal moulds of a desired shape. Still another technique, known as die-casting, forces the metal into a die under great pressure. Another plant, at Sterling Road in Toronto, founded in 1912, makes pots and pans as well as die castings. This was the first aluminum manufacture in Canada.

Unlike the four production plants which produce but a single item—aluminum ingot—the three fabrication plants at Kingston, Toronto and Etobicoke, produce a vast number of items. The shipping rooms of these plants receive aluminum as ingot and ship it out in a wide variety of forms to a tremendous number of customers. Some of this material goes abroad but much of it is used in Canada. Indeed, these plants supply more than 1,000 companies in Canada which use aluminum for the production of many thousands of different products used at home and abroad.

Cataloguing the uses of this light metal would be a most difficult task, not only because of the vast range of applications, but because aluminum is constantly entering, and proving its worth in, new and different fields. Indicative, perhaps, of the final destination of this material is the fact that about twenty per cent of it is used in building and construction; about twenty-five per cent in all forms of transport—such as aeroplanes, automobiles, buses, trucks, ships and railroad cars; some twenty per cent of the metal goes into household supplies, being used for all forms of furniture and appliances, in addition to utensils. Another twelve per cent is used in the electrical industry. Canning and packaging have become important outlets for this metal in the last few years, while the chemical industry, agricultural industry, mining industry—in fact, almost every known phase of human effort—use it in large quantities.

Expansion of Canada's Aluminum Industry

In its early beginnings the aluminum industry assumed the role of a pioneer in the world of metals, developing new uses and new markets as it increased production



and fabrication capacity. The search for new uses and new markets, together with exploration for new ore reserves and new power sites, has been continued with the greatest intensity. In every decade since the turn of the century production has doubled, and now the output of aluminum is greater than that of all other metals except iron and steel.

This policy of preparedness, of planning far ahead of present needs, has not only speeded the progress of the Canadian aluminum industry but has also provided a measure of security for times of emergency. When Canada and the world reached a crossroads of history in 1939, aluminum became a material of vital importance to the Allied Nations. Geographical location, natural resources, and the industry of her people led Canada into the spotlight as an arsenal of democracy. The assurance with which she assumed this responsibility and the momentum created by the effort carried her forward with giant steps to her status of world-wide importance as an industrial and trading nation. This was possible because, when the test came, Canada was in a position to meet it.

Aluminum was a determining factor in Canada's war effort. Made spectacular by the impressive fleets of light-metal planes which filled the sky, aluminum exercised tremendous appeal to the public imagination. The metal-hungry Allies clamoured for more aluminum. The Canadian industry responded in dramatic fashion. Within a few years a fourfold expansion of the industry occurred, an expansion depending for success on an unprecedented development of the vast network of enterprises at the heart of which were the production centres. This extraordinary response to the challenge of history did not stem from hastily made plans. In many instances it involved the carrying out of plans carefully prepared in anticipation of future needs long before the emergency arose. Quick changes in plans were necessary, it is true, and for several years life in the aluminum industry was exceedingly hectic, but its policy of preparing for

Right: The sheet and extrusion plant at Kingston, Ontario.

Far left: Aluminum does not rust and reflects the sun's heat. It has become a popular roofing material for farmers' barns.

Left:—Latest application in the transportation industry is this all-aluminum box car which is considerably lighter than its steel counterpart.

One of the first construction camps at Kemano (some 350 miles north of Vancouver) where a huge cavern will be dug inside the mountain to house the generators to produce the power for aluminum in British Columbia.

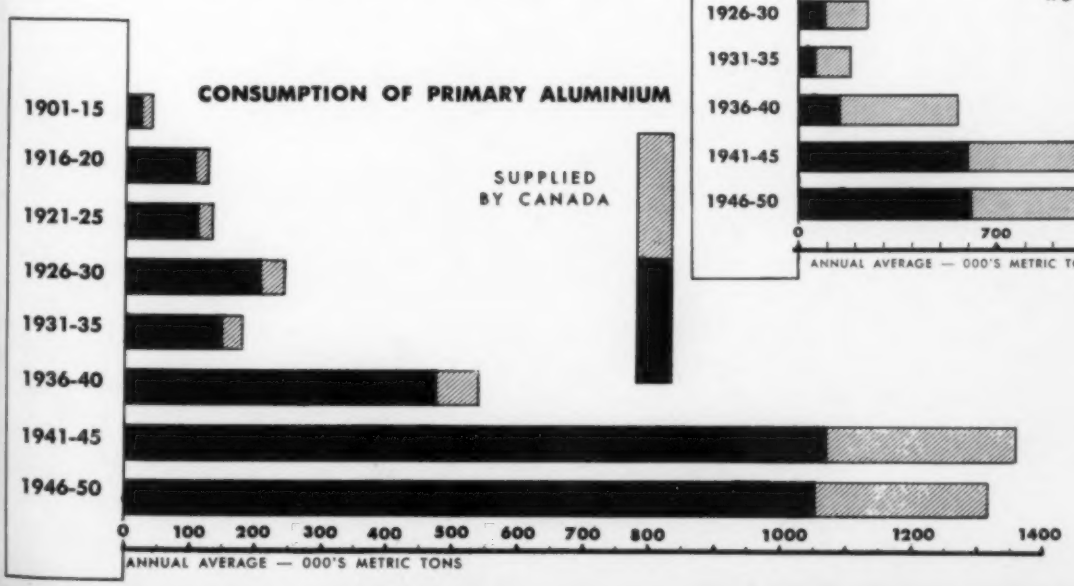
An artist's conception of the ten-mile-long tunnel through solid rock from Tahtsa Lake dropping water 2,600 feet to the generators in the Kemano powerhouse.

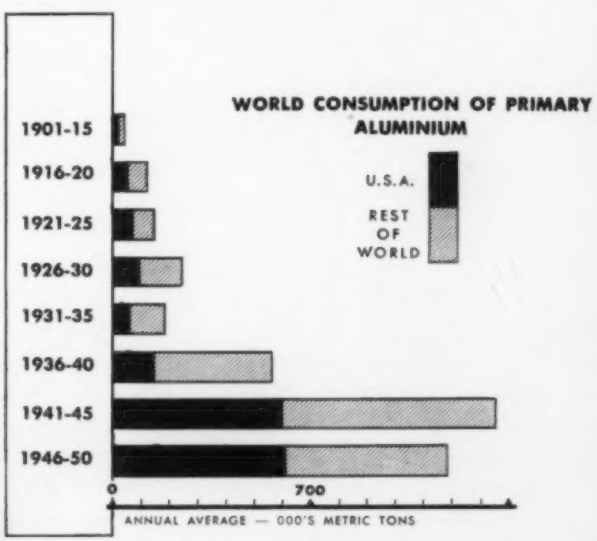
One of the main reasons for the aluminum industry's spectacular growth has been its emphasis on constant research. Here a sample is being checked for tensile strength.

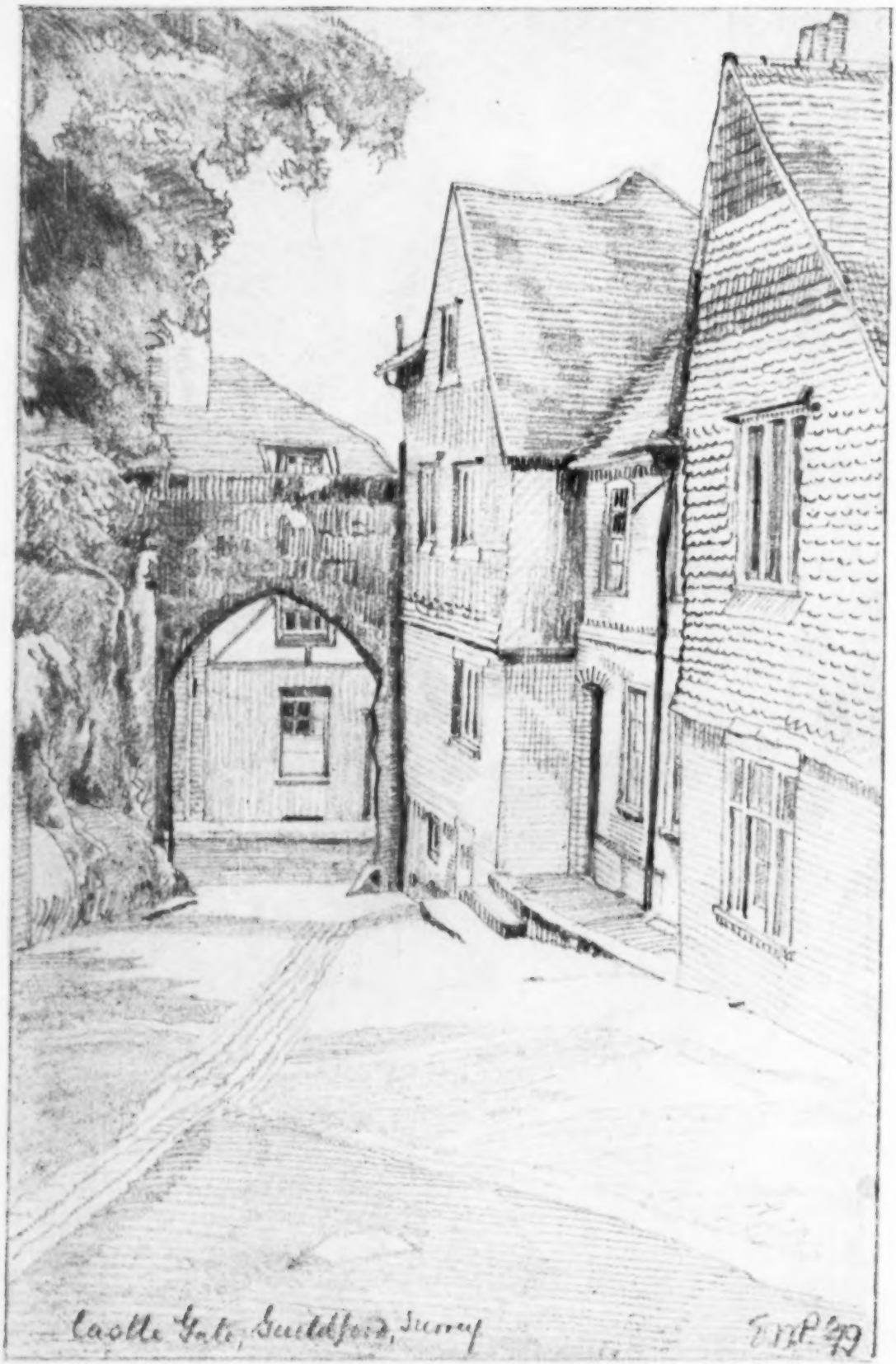
the future in advance enabled the company to serve Canada and the world in time of need.

This striking success has in no way diminished the pioneering spirit of the organization. Even today the engineers, scientists and workmen of the Aluminum Company of Canada Limited are engaged in a project of great magnitude in a remote mountainous area of British Columbia on Canada's west coast. Seeking, as always, for new sources of low-cost power, the company spent over $1,000,000 for surveys and engineering studies to explore the possibilities of this area. Breath-taking in scope, the west-coast operation visualizes a project in which huge dams will restrain the eastward flow of the Nechako River which drains a chain of lakes in the tableland area of Tweedsmuir National Park. These dams will form a reservoir more than 100 miles in length and the waters of the area will then flow not east but west, through a ten-mile tunnel built through the solid rock of the mountain. This water will then fall a total height of 2,600 feet through tunnels ten miles long to a power-house built into the base of the mountain. The height of the fall will create conditions favourable for the completion of a great power project which, in turn, will feed the smelters that are to be located a few miles away. Plans are being completed for the development of 2,000,000 horsepower on this site to feed a smelter which may eventually have a production capacity of 1,100,000,000 pounds per year —an amount greater than the present capacity of all existing Canadian plants.

Large though this project is, it is but another milestone in the progress of a metal which, a century ago, was as scarce and as expensive as gold. Experienced men, money and materials will be required in great abundance on the project, and the effects of this effort will be felt by all Canada. Its completion will bring new strength and growth to the aluminum industry, increase Canada's prestige and power among the world family of nations, and provide for Canadian people and Canadian business the far-reaching benefits and opportunities which flow from constructive and successful enterprise.







(1) *Castle Gate, Guildford, Surrey.*

Guildford, Surrey

by EDGAR W. PITT

GUILDFORD, the capital of Surrey, is situated on the declivity of a hill rising from the bank of the River Wey; it consists primarily of one long street, beginning at the bridge and extending eastwards about half a mile up the hill. The town was first incorporated by charter of Henry III, confirmed by Henry VI, and again by Henry VIII, when the title of mayor was conferred on the town's chief official. The Corporation now consists of a Mayor, eight Aldermen, twenty-four Councillors, a Recorder, Town Clerk, and High Steward. Guildford returned two members of Parliament from the days of Edward I until 1867, when the number was reduced to one; and in 1885 its representation was merged with that of the county.

The earliest mention of Guildford occurs in the will of Alfred the Great (in 900) whereby he bequeathed it, together with Godalming, to his nephew, Ethelwald. The castle was built in the days of Henry II. In 1216 it was seized by Louis, Dauphin of France, when in pursuit of King John. It is occasionally mentioned in the reigns of Henry III and the Edwards on the appointment of successive Constables, but there was no great historical event connected with it. During the fifteenth century it was chiefly used as the common county jail. James I granted the five acres on which the castle stood to Francis Carter, then Mayor of Guild[f]ord. When the Civil War broke out, it was in such a bad state that neither side attempted to hold it. After a long period and much changing of hands, in 1885 Lord Grantly sold the ruins to the Corporation, which laid out the grounds for the benefit of the public. The walls of the square Norman keep still stand. Ten feet thick and constructed chiefly of rubble and Roman tile, they were erected on an older artificial mound; their present height is about seventy feet. A feature to be noted is the oratory, which has a wall-arcade on which are graffiti cut by prisoners.

The Town Museum in Quarry Street (see sketch No. 1) adjoins the Castle. Here, in the first room, you are back at work with palaeolithic tools found in the neighbourhood of Farnham, or you pass on to days of bronze, with a hoard of metal hidden as his reserve by a smith at Coulsdon; and then through many a millennium to the moulding of box-flue tiles for a Roman villa on Ashtead Common, to window-glass and tessellated pavements; and then—with sudden pleasure in gaining knowledge of what was living—you observe the footprints of dogs and the claws of a wild cat in clay that was wet as the Roman builder spread it.

Stairs lead up to our own English iron age, to the days of wrought- and cast-iron work used on hurdles and in kitchens—basket spits, idle-backs, lazy-backs, kettle-tippers, kitchen hangers, "black cats" of crossed rods for plates of toast; ox-shoes or *ques*—two shoes on each foot, one on each "claw"; and to viler uses of iron for fox-traps and a large man-trap (from Loseley Park).

There are reminders of other uses of iron in what we may still call our own time. In a further room the visitor finds a case of various relics, among them the big key of the old Hog's Back turnpike gate, which was closed in 1876. Near to it are staves used by special constables during the riots in Guildford between 1859 and 1865. A savage weapon is the bludgeon carried by the leader of the "Guys", with which an attempt was made to murder police-constable Stent, and with which another constable was so seriously injured that he died; this is two-and-a-half feet long, heavily studded with nails, with a sharp spike at the end.

It is pleasant to come back to peaceful uses of wood. There are many quaint household implements in the collection presented by Miss Jekyll: butter-scoops, wooden scales, punch ladles, trenchers, lemon-squeezers; huge mouse-traps, more like cages than traps,

(2) *High Street and Guildhall, Guildford.*

and dead-fall traps with wooden blocks which I should like to weigh; flails of ash bound with raw hide and with heads ingeniously held to swing as loosely and heavily as possible (the flails were called *frails* and the heads *swingels*, pronounced as if the *g* were *j*). But to list all the tools and other farm and household furniture would be to reprint the pages of Miss Jekyll's unique book, *Old West Surrey*.

One delightful exhibit in particular attracts children. In the corner of the end room but one stands a small wooden carriage designed (about 1830) to be drawn by dogs; its body is swung on leather straps and the wooden wheels have iron tires. This was presented by the Misses Williamson, one of whom used to travel to school in it as a child.

Sketch No. 3 shows a mediaeval door in Quarry Street. Also in this street stands St. Mary's, the oldest and most interesting church in Guildford. Of irregular plan, it was drastically restored in 1863. The core of this cruciform church (1160-80) is Transitional Norman; the nave arcades, with their richly scalloped capitals, the apsidal chapel terminations, the vaulting of the chancel, and other less obvious details all point to that period. Experts agree that the greater part of the central tower is of pre-Conquest date. This massive tower, with double-splayed lights and pilaster strips, has had the Norman church built round it; but it is quite clear that the Saxon tower was not a central one on a cruciform plan, for the strips ascend from ground level on the north and south sides, which must have served originally as external walls. The lancets and doorway in the north aisle show that this part was rebuilt in the first half of the thirteenth century. In the chapels there are parts of different fourteenth-century dates and also traces of fifteenth-century work. In St. John's Chapel there are traces of wall paintings.

The two other parish churches of Guildford are Holy Trinity ("High Church"), and St. Nicholas ("Low Church"), St. Mary's being known as "Middle Church". On an old engraving, Holy Trinity, near the Castle, is shown as having possessed a low, squat spire on a central tower and an apsidal termination to the north aisle. Some injudicious repairs endangered the safety of the steeple, and on April 23rd, 1740, it fell and ruined the whole church. The present brick structure was begun in 1749 but not finished until 1763, the east end later being enlarged and rebuilt in 1888. The only part of the old church now existing is the Weston Chantry; founded as late as 1540, it now serves as a vestry. Beneath the tower are a few old stones, including some of Norman date. The most noteworthy of the monuments are those of Archbishop Abbot, who died in 1633, and Speaker Onslow, 1768.

The old Church of St. Nicholas near the bridge in the lowest part of the town was demolished, excepting the tower and the fifteenth-century Loseley Chapel. The latter contains some fine Elizabethan monuments

of the Mores of Loseley, and the beautiful canopied tomb and effigy of Arnold Brocus, rector, 1395.

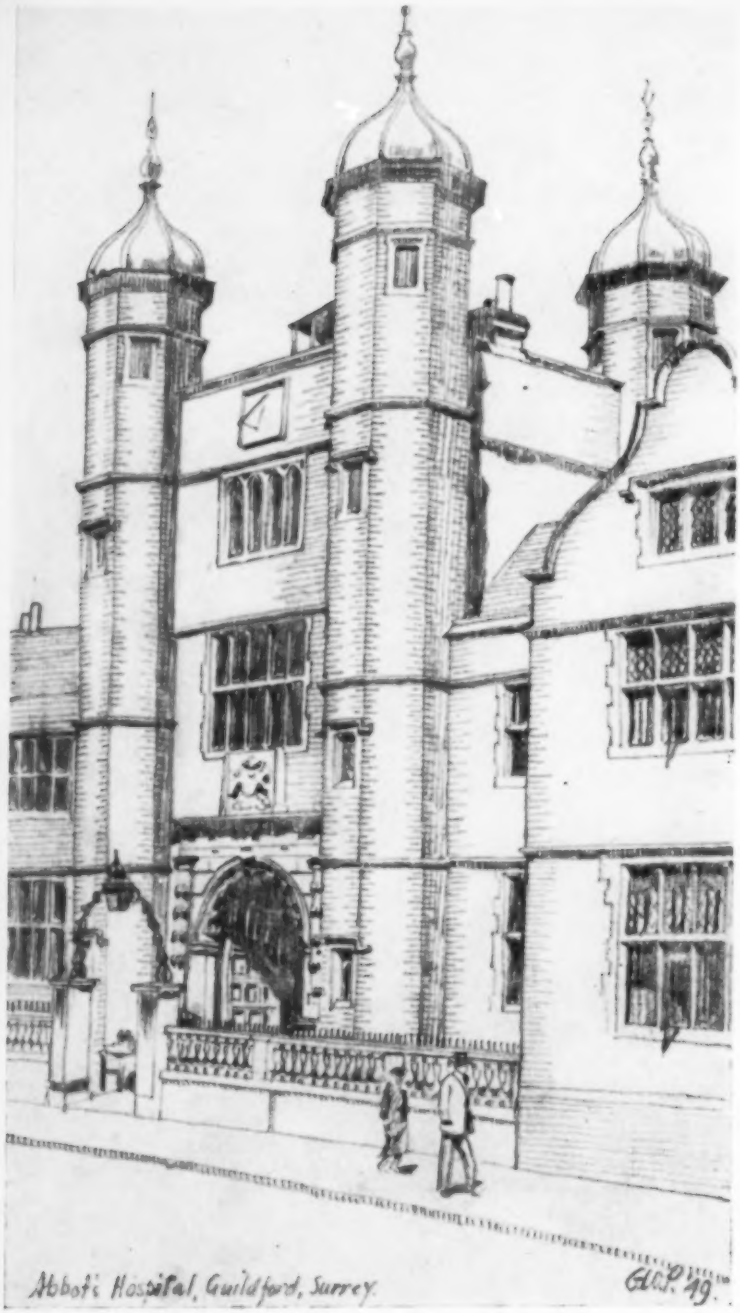
Perhaps the most notable building, architecturally, in Guildford is that of Abbot's Hospital (see sketch No. 4) at the top of the High Street; it was founded in 1619 by George Abbot, a native of Guildford, later to become Archbishop of Canterbury. The idea of founding this hospital for the support of a master, twelve brethren, nineteen sisters, and two nurses, was suggested to Abbot by the action of Whitgift, his predecessor, who founded a similar establishment at Croydon. Built of brick, the exterior is very attractive, especially in the beauty and variety of its moulded chimney-shafts. The most valuable feature of the interior is the stained-glass windows of the chapel.The dining-hall, which retains all its original fittings, is a strange example of the distinctly irreverent humour in which grim Puritans like Abbot were capable of indulging.

Another remarkable building in the High Street is the stone-built Royal Free Grammar School (see sketch No. 5), with its three small gables. A wicket in the old door gives access to a very small quadrangle. Over the entrance is an inscription in gilded letters giving false honours to the boy-king, Edward VI, as the founder of the school; it reads: "Schola Regia Grammaticulis Edvardi Sexti, 1550". In fact, as A. F. Leach in his remarkable book *English Schools at the Reformation* (1896) has conclusively shown, the historically true title for Edward VI is "The Spoiler of Schools". The founder of Guildford Free School was a townsman, Robert Buckingham, who died in 1509. Edward VI, at the strong urging of Lord Northampton, warden of the manor, and of Sir William More of Loseley, consented to add to the endowment, in 1553, the revenues of three small Surrey chantries from among the vast number the Crown had ruthlessly confiscated.

The most conspicuous feature of the High Street is the large projecting clock (dated 1683) above the overhanging balcony of the Town Hall (see sketch No. 2). The lower storey of this interesting building is open in front to the roadway. Above, supported by huge and grotesque brackets, is the slightly projecting council-chamber, whilst the whole is surmounted by a cupola-crowned bell-turret. The hall contains a variety of notable portraits, outstanding amongst which are two by Lely of Charles II and James II.

Beneath the Angel Hotel (sketch No. 6), an ancient hostelry, and another house on the opposite side of the High Street, are cellars with good groined roofs of the thirteenth century. Messrs. J. Charles Cox and Philip M. Johnston inform us that the bet-

(3) *Mediaeval doorway in Quarry Street, Guildford.*



(4) *Abbot's Hospital, Guildford.*

ter-class houses in old English towns were usually build over vaulted cellaring. This has given rise to the popular, but erroneous, opinion that these houses had ecclesiastical foundation. Certainly, however, in the case of Guildford, as with so many of our old towns, there existed a house of the Dominicans or Black Friars which, though long disappeared, is commemorated by Friary Street.

Beyond doubt High Street has great distinction, not only on account of the number, variety, age and architectural distinction of the buildings lining each side of it, but also owing to the slope up which it runs. Congestion problems here were greatly alleviated some years ago by the creation of the Guildford-Godalming by-pass which diverted through-traffic by the Portsmouth Road.

On Stag Hill, near the station, the Cathedral of the new Guildford Diocese is under construction. Some twenty years ago Winchester Diocese, having been found too large for administration as one unit, was divided into three—Winchester, Portsmouth and Guildford. The foundation stone of Guildford Cathedral (which is only the third entirely new Anglican Cathedral to be built in England since the Protestant Reformation) was laid by the Archbishop of Canterbury on July 22nd, 1936, the dedication being: "The Cathedral Church of the Holy Spirit in Guildford".

The Cathedral forms a true cross in plan. In design it is in line with the great English Cathedrals, but modern methods of planning and construction have been employed where these have proved to be enduring. The main structure will be of brick, the facing bricks being made of the clay of Stag Hill itself. Clipsham stone is being used for the external dressings, its cream colour harmonizing well with the rose colour of the bricks. Internally the brick walls will be finished in plaster of the same colour as the Doulting stone used for piers and plinths. The vaulting will be of reinforced concrete as a precaution against fire and the roof covering will be of copper.

The internal length of the Cathedral from the west door to the east end of the Lady Chapel will be 365 feet; the internal height of the vaulting, 68 feet. The tower will be 157 feet high with a flag-staff, surmounted by a mitre, just reaching 200 feet from ground level.

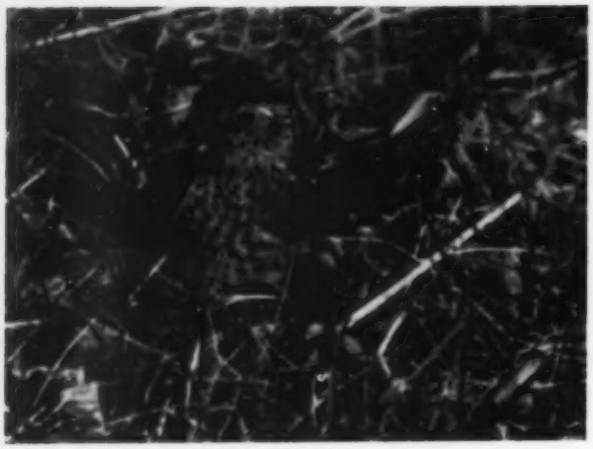
When finished, the Cathedral will seat nearly 2,000. Ten years ago nearly half the superstructure was built—the chancel, the transepts, the crossing under the great central tower, the Chapel of Chivalry, the Children's Chapel, the vestries and the crypt. Since the end of the war, work has proceeded steadily. The architect is Mr. Edward Maufe, A.R.A., whose design was chosen in open competition.

(5) *The Grammar School, Guilford.*

(6) *The yard of "Ye Angel Hotel", Guildford.*

Up to the beginning of World War II many new houses were built in Guildford, partly in the direction of Merrow, but mainly in the area between Hog's Back and Stoughton, west of the town. The Cathedral will form a prominent feature in the latter tract.

And, finally, it is of interest to recall that Lewis Carroll (Charles Lutwidge Dodgson) is buried in Guildford Cemetery, the house in which he died ("The Chestnuts", Castle Hill) being marked by a plaque.



The least sandpiper, like many others of its family, nests in the Canadian Arctic.

Wild Wings over the Tundra

by EVA BECKETT

Photographs by the author

THE VAST WINDSWEPT tundra region of northern Canada is the summer home of countless numbers of birds. From hundreds, even thousands, of miles away these feathered songsters speed northward each year, bringing beauty and cheer to a land gradually awakening with the advent of spring.

Up they come from Mexico and Martinique, from Bolivia and Brazil and other countries of the south, to make their nests and rear their young in this solemn, sparsely-settled region. They are *our* birds now — birds of Canada, but for a few weeks only. For as soon as the brief northern summer draws to a close, they are on their way to the south again, some travelling by circuitous routes and touching down on many lands along the way.

Water-fowl and marsh-breeders are especially noticeable among these summer residents. Ducks, geese, swans, cranes, plovers, phalaropes, sandpipers, gulls, godwits, dowitchers, jaegers, curlews, and a host of others frequent the innumerable tundra lakes and sloughs. And of the land birds snow buntings, pipits, longspurs, horned larks, ravens, rusty blackbirds, robins, thrushes, hawks, owls, warblers, and sparrows are the most common.

A Hudsonian godwit stealing from its nest to feed at dawn.

Snow buntings, or snowbirds, are the first to arrive. Their cheery *teer-teer* is sweet music in the ears of any northerner. For with this gentle bird-song spring is heralded to the tundra — and there is little other evidence of spring's approach, apart from lengthening days, when the first snow buntings arrive early in April.

How these little wanderers make their way northward over vast snow fields and find enough to subsist on until the snow has gone is one of nature's mysteries. Great flocks of them swirl over the open plains like clouds of driving snow. Down they sweep and light to snatch a seed or two from dry stalks sticking up through the drifts; then off they wheel again, filling the air with pleasant, excited twitterings.

They take time, however, for frequent grooming of their natty black-and-white spring plumage. First comes a snow bath. Snow bathing can be such fun — for a snowbird! The little creature plunges its head into a soft snow bank, braces itself with both feet and, with quick rotary wing-beats, flicks the snow repeatedly through

its feathers until all are thoroughly washed. This is followed by careful preening when, one by one, each feather is rubbed and oiled and smoothed into place.

At the time of their arrival in the North, these harbingers of spring have little to fear from feathered foes. Predatory birds, such as snowy owls and gyrfalcons, that dwell in the Arctic the year round, are not numerous in any locality. But later come short-eared owls and various members of the hawk family, with killers among them. Many a little bird is struck to earth by a ruthless goshawk or by that fierce master of the air — the peregrine falcon, which, on occasion, will drop from the sky like a thunderbolt, leaving death in its wake.

Falco peregrinus—"the wandering sickle", as this falcon is well nicknamed — is the magnificent bird of falconry that rode to the hunt on the wrist of king and courtier. On this continent its fierce, restless nature drives it far in its wanderings. From coast to coast and deep into the Arctic it is known as a casual visitor. Its common name of "duck hawk" gives an erroneous impression since ducks form a relatively minor part of its diet. It hunts many smaller birds, sometimes apparently for sheer sport. More than once we have seen it cut a lightning-like swath through a flock of small birds and leave its victims untouched on the ground.

Warmer spring days bring flocks of horned larks to the tundra where, like the skylarks of Europe, they sing their wild joyous songs as they soar high overhead. Many of them spend the summer in subarctic regions; others follow the snowbirds to nesting grounds along the northern rim of the continent. Like snowbirds, too, they start nesting early, often before the snow has gone, and, since it takes only eleven days to incubate the eggs in their simply-constructed nests on the open ground, two broods are generally hatched in a season. Yet the lark population does not increase unduly; mortality of their young is high, for, in addition to destruction by predators, many a clutch of eggs or brood of young is wiped out by late snow storms or cold spring rains.

Above:—Snow drifts are still deep on the tundra when the first snow buntings arrive early in April.

By the second week of May migration across the northern plains is well under way. Millions of birds from many lands are speeding unguided through the skies. Ducks and geese and swans appear as soon as there are bare spots on the tundra and enough open water to form a landing-place. By day and night they come — some, like the snow goose, bound for far-off arctic islands; others dropping down here and there as they sight a suitable nesting place.

The tundra's many lakes and sloughs provide suitable nesting sites for water-loving birds. Rocky uplands attract larks, pipits and longspurs, and the shrubby growth about them yields shelter for warblers, redpolls, and members of the sparrow family, of which Harris' and the white-crowned are most common. And scattered wooded regions, which consist chiefly of stunted, wind-tossed spruce and tamarack, are the haunts of grey-cheeked thrushes, Canada jays, rusty blackbirds and Bonaparte gulls.

As tree-nesting birds, Bonapartes are radicals in the gull family but, like others of their kind, they frequently dwell in colonies. It is amusing to watch them carrying material for their nests — great bunches of lichens that hang from their beaks like grey beards. These are spread on the thick upper branches of a spruce tree and shaped into a bulky nest that will later hold three large mottled green eggs. The safeguarding of each nest in the colony is a matter of concern to all. When an enemy approaches, every gull in the vicinity shrieks and attempts to drive it off.

Toward the end of May there comes a day when the shrill call of a lesser yellowlegs or the plaintive bell-like note of a golden plover announces the shore-birds' return. Myriads of these little wanderers journey to

Windswept tundras on the west coast of Hudson Bay look big and bleak to this tiny savannah sparrow.

A handsome summer resident of Canada's Northland, the golden plover sets off in the fall for the pampas of South America.

Far left:—The pintail duck hides her nest deep down in thick grasses.

Left:—The Lapland longspur's nest is woven of grass and comfortably lined with feathers.

the Northland each year. Here, all through the long spring days they flit about in fantastic courtship flight and fill the air with their guttural cries and extraordinary love songs — songs heard only in their nesting grounds, and which, strange though they may be, express the mood of the Northland and are completely in harmony with the landscape. The tenderest of all, perhaps, is the gentle flute-like love call of an Arctic loon.

To reach their northern summer home most shore-birds come amazingly long distances. For example, willets that rear their young in the Canadian Arctic return each spring from winter haunts in Texas, avocets come from Guatemala, dowitchers from Brazil, and knots from Patagonia. Wilson's snipes come from Central and South America, while red phalaropes that flit along the sunny shores of Chile throughout our winter months fly back the length of two continents to make their nests on Ellesmere Island at the northernmost tip of Canada.

Above:—Bonaparte gulls build their nests in the branches of the tundra's spruce trees.

Below:—Herring gulls return each spring as soon as there is open water.

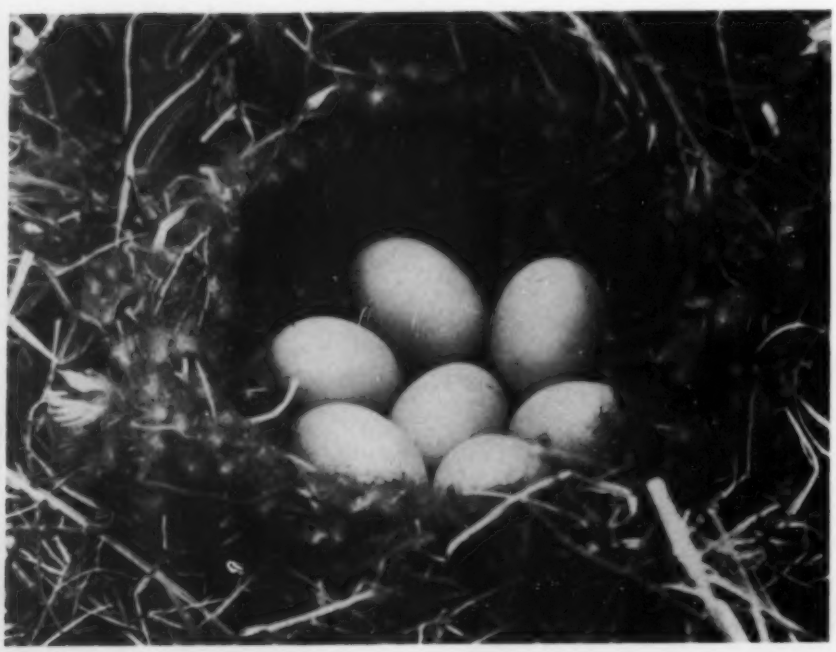
Left:—A semipalmated plover anxiously guards her four large eggs.

Below:—Like the young of most shore-birds, these newly-hatched chicks of a semipalmated plover will leave their nest almost as soon as the down on their bodies is dry.

Of these summer visitors, phalaropes are among the most interesting. Like tiny ducks swimming high in the water, they circle round and round the shallow ponds, stirring up the midges and other little creatures on which they feed. In contrast with domestic affairs in most bird families, things seem strangely changed about in the phalarope family; for the female wears the brighter colours and it is she that sets out in springtime to woo and win a mate. The male incubates the eggs and cares for the young.

But of all the summer visitors, few bring more charm than the Arctic terns. The essence of grace and joyousness, these lovely slender-winged birds skim over the ponds and northern seas from the end of May or early June until mid-August. Their stay is very short, yet in these few weeks there is sufficient time for their eggs to incubate and the young to grow strong enough to set off on the long, long autumn migration. For Arctic terns are the world's most amazing long-distance fliers. Wintering on islands of the Antarctic and nesting in the Canadian Arctic, they make an annual round-trip of approximately 24,000 miles.

It is always a surprise to find yellow



Seven pale olive eggs fill this cosy nest of a green-winged teal.

Right:—A golden plover on her nest.

Below:—Characteristic nest of an Arctic tern. To rear her young in the Canadian Northland, this tern makes an annual round-trip of approximately 24,000 miles.

warblers summering in these northern latitudes. From the Gulf States to the Canadian Arctic is a long journey for such dainty little travellers. Yet, by the middle of June they are here, singing as sweetly as others of their kind that summer a thousand miles or more farther south. Their nests are usually built in the branches of small willow trees, some of the fluffy white cotton from the trees' ripened catkins being used in their structure.

Others of the warbler family, such as the blackpolled, myrtle, and orange-crowned, are also familiar in the North, but they cling more to the wooded areas, haunts that are shared with chickadees and woodpeckers and an occasional flicker.

Robins are fairly common visitors in most tundra regions but their songs never sound as rollicking as those heard in more southern parts of Canada. Nor are the birds quite so domesticated. They are characteristically more shy and secretive about their nest-building. This may be the result of years of misplaced confidence, for nests built near the hut of either Indian or Eskimo are apt to fare badly.

One of the familiar sounds of spring is the

Newly-hatched young of the Arctic tern. (See eggs above left.)

curious barking call of the willow ptarmigan, or Arctic grouse, a bird that remains in the North the year round and is unique in that the colour of its plumage matches its background at each season. The brown plumage that makes the nesting bird so difficult to find changes to snow white when winter sets in. And in spring and fall, when there are patches of snow on the ground, the bird is again unobtrusive in its parti-coloured plumage.

The mother willow ptarmigan guards her nest so closely that, even when it is discovered, she has to be practically pushed off before she will leave her precious eggs. These range in number from eight to eleven and are so beautifully marked and coloured that they, too, are difficult to distinguish from the grasses or lichens in which the nest is made.

During the long winter season the willow ptarmigan's food consists chiefly of the buds of willows and other plants that stick up through the snow. In order that the bird may walk about freely from bush to bush to feed at this season, a curious change takes place in its feet. Its claws grow longer and sharper to aid it when crossing over hard snow or ice, while long, hair-like feathers that grow over its feet support it, like snowshoes, in soft snow.

Bird-watching in the North brings many a surprise. One never knows when some gay little feathered adventurer, hundreds of miles off its course, may stray into this great, lone land. How can one account for the mountain bluebird, far from its familiar summer haunts in western mountain and prairie regions, that chose to spend a lovely June day investigating the little willows by our cottage on the bleak west coast of Hudson Bay ? Or, stranger still, the humming bird that sipped nectar from the fragrant bloom of Lapland rhododendrons beneath our kitchen window one morning in the spring of 1942 — and came again (or was this another of its kind ?) to the same plants six years later ? Or the exotic pair of scissor-tailed flycatchers that, in the summer of 1949, extended their flight northward by a thousand miles to feast for a fortnight on the tasty insects of the Churchill district ? Storms may have driven these birds far off their normal course — but perhaps there are among birds, as among men, certain particularly adventurous spirits.

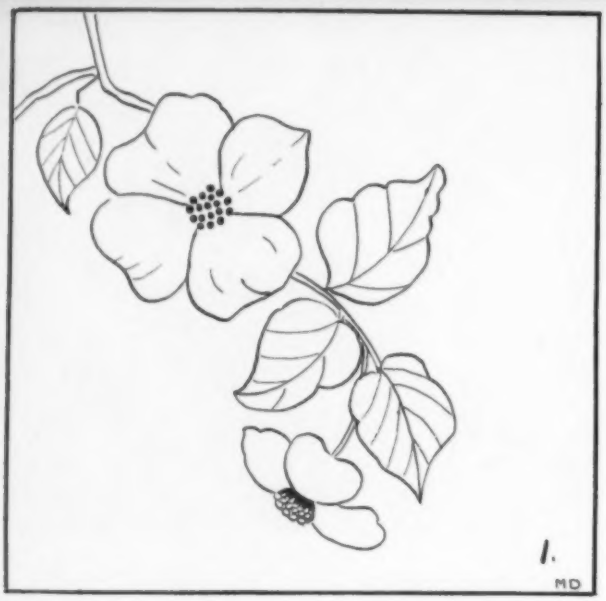
As northern frontiers are pushed back, changes in the bird population of newly-opened regions are very soon noticeable. Shore-birds and water-fowl especially move on in advance of encroaching civilization. Fortunately for them, there are vast tundra areas, as well as numerous islands of the northern seas, still untouched by the march of progress. Here, throughout the Arctic summers — so beautiful and so fleeting — countless numbers of birds continue to find a sanctuary in which to pour forth their annual rhapsody of sweet love song.

The yellow warbler builds her pretty nest in the branches of small willows, weaving into its structure some of the down from ripened willow catkins.

Above:—The eggs and newly-hatched chicks of a willow ptarmigan; it is difficult to distinguish the nest from surrounding grasses.

Left:—The willow ptarmigan, which remains in the North the year round, is well camouflaged, for at each season its plumage blends with the landscape.

As winter approaches, the plumage of the willow ptarmigan gradually changes to snowy white, and long hair-like feathers grow over its feet.



Floral Emblems of the Provinces

Canada is blessed with a great variety of beautiful flowers, flowering trees, and shrubs and it has been difficult for each province to decide on a representative flower. Some provinces have not as yet legally pronounced a choice but each has, by common consent, adopted a flower for its emblem.

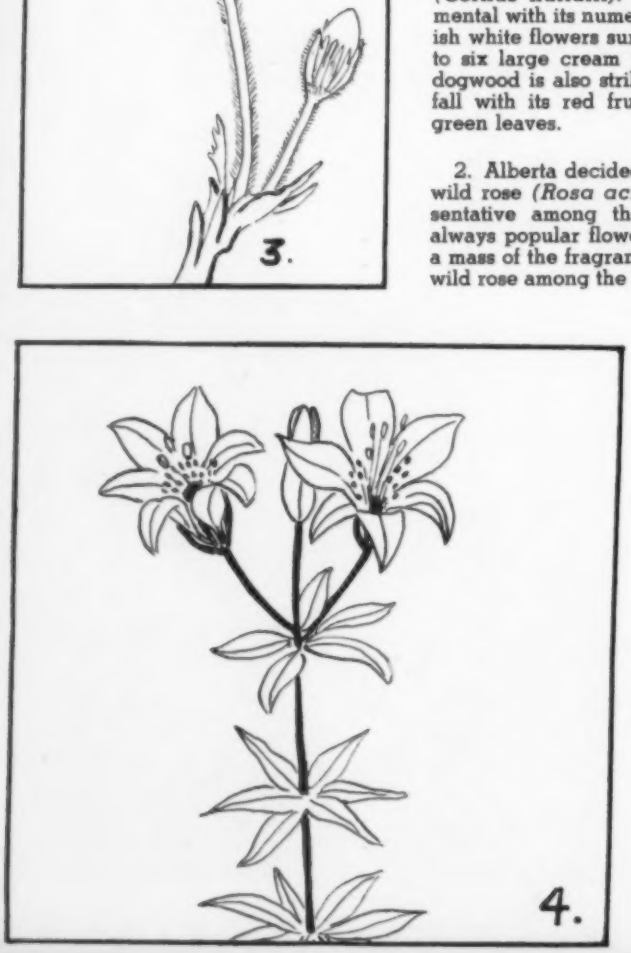
1. British Columbia by popular choice has selected the flowering dogwood *(Cornus nuttalli)*. This tree is very ornamental with its numerous clusters of greenish white flowers surrounded by their four to six large cream petal-like leaves. The dogwood is also strikingly beautiful in the fall with its red fruit and deep red and green leaves.

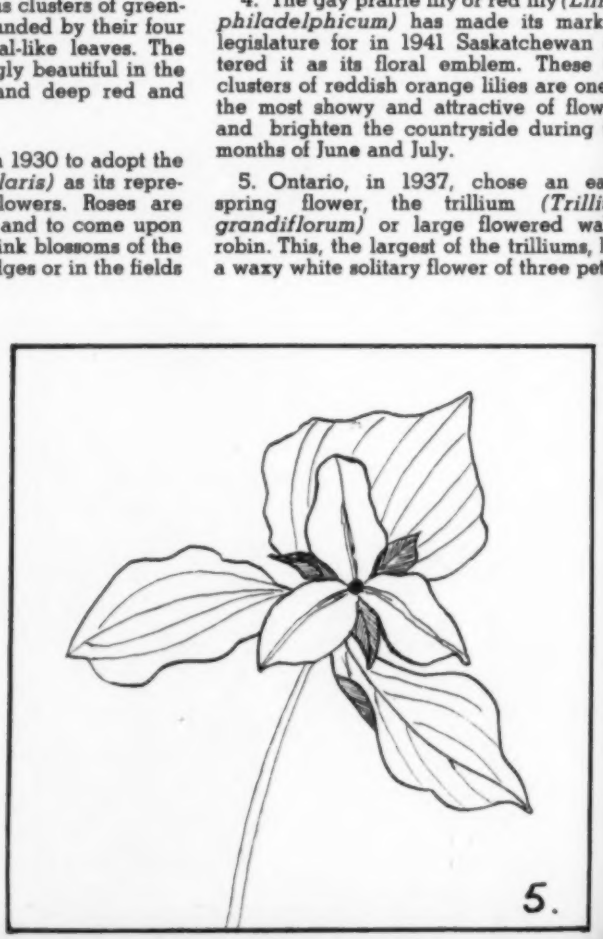
2. Alberta decided in 1930 to adopt the wild rose *(Rosa acicularis)* as its representative among the flowers. Roses are always popular flowers and to come upon a mass of the fragrant pink blossoms of the wild rose among the hedges or in the fields is to realize that the people of Alberta have made a wise choice.

3. Manitoba was certain of its choice as long ago as 1906. That choice was the wild crocus or pasque-flower *(Pulsatilla ludoviciana)* which, each spring, grows in such abundance that its blossoms give a soft purplish hue to the prairie. It is one of the earliest flowers and because of its furry petals it is sometimes referred to as the "gosling plant".

4. The gay prairie lily or red lily *(Lilium philadelphicum)* has made its mark in legislature for in 1941 Saskatchewan entered it as its floral emblem. These tall clusters of reddish orange lilies are one of the most showy and attractive of flowers and brighten the countryside during the months of June and July.

5. Ontario, in 1937, chose an early spring flower, the trillium *(Trillium grandiflorum)* or large flowered wake-robin. This, the largest of the trilliums, has a waxy white solitary flower of three petals





by MARION DICK

rising from a whorl of three large broad green leaves. The flowers are scentless and as they mature they become pink.

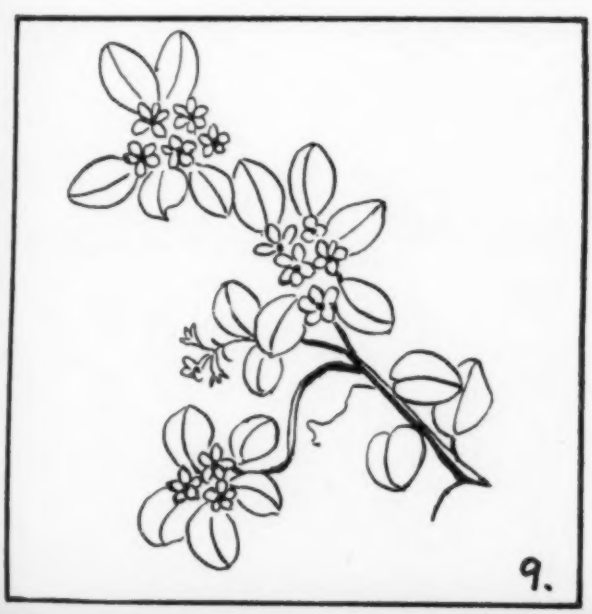
6. The wild blue flag *(Iris versicolor)* has been used as symbolic of the fleur-de-lis for the province of Quebec. These large handsome flowers are variegated with white, green and yellow and stand out strong and imposing against their sword-like leaves.

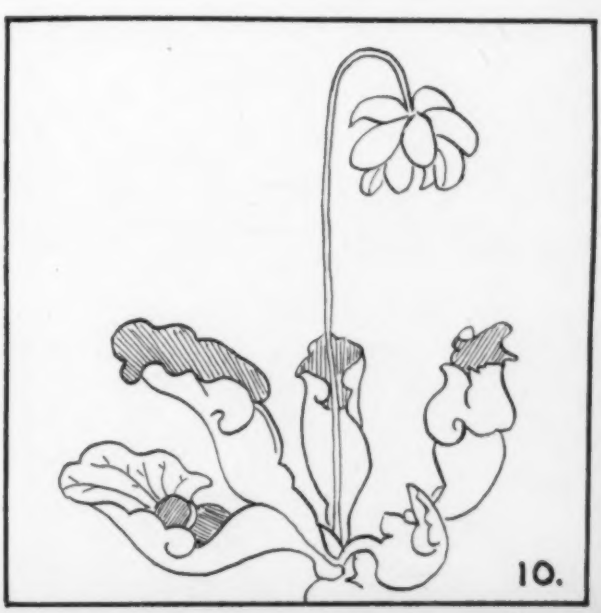
7. New Brunswick by order in council in 1936 chose the violet. The scientific name has not been designated and it is not certain which of several species of blue or purple *(Viola cucullata)* violets is intended. Violets are a happy choice for they are one of the early flowers of spring and are perhaps the best known and loved of all the wild flowers.

8. The showy lady's-slipper *(Cypripedium hirsutum)* is the popular choice of Prince Edward Island. This fragrant flower is considered by many to be the most beautiful of our native orchids. The white pouch or "slipper" is streaked with crimson and surmounted with white petals. The flower is set off by large pointed oval green leaves.

9. Nova Scotia was early in discovering the beauties of one of its native flowers for long before its official adoption in 1901 its emblem was trailing arbutus or mayflower *(Epigaea repens)*. This lovely plant belongs to the heath family and is an evergreen. The delicate pink blossoms form rather large clusters on the ends of the branches and have a rich spicy perfume.

10. Newfoundland had the honour of having Queen Victoria select the pitcher plant *(Sarracenia purpurea)* as an emblem for the Island. This interesting plant is sometimes called Indian dipper or huntsman's cup. It has broad hooded leaves which become partially filled with water and they capture and absorb insects in order to obtain extra nitrogen for the plant's growth. The large reddish purple flower is lined in light green and grows from a long stem one to two feet tall.





Geography in the Universities of Canada*

by J. LEWIS ROBINSON

THE emergence of geography on a professional level is a recent development in Canada. Although it was taught in the primary and secondary schools in the last century, and geography text-books have been written by Canadian teachers, only recently has geography been introduced into the academic programs of universities. In this respect Canadian education has been far behind developments in European universities, and also behind the United States, which recognized the importance of geography early in this century.

Origins in the Universities

The first record of a geography course in a Canadian university is that listed in the curriculum of the University of New Brunswick at its inauguration in 1800. The general field of earth or physical science was covered by this course, but when it disappeared, and what influences or effects it had, we do not know.

Quebec has been a pioneer and leader in Canadian geography. The first recorded chair of geography was at the *École des Hautes Études Commerciales* (affiliated with the *Université de Montréal*) in 1910. The first professor was Henry Laureys. In the next decade the staff was expanded with the addition of professors F. Vézina and P. Ste-Marie, but geography never reached the status of a department. Throughout the years geography has remained an important part of the school's commercial training. Benoît Brouillette joined the faculty of the *École des Hautes Études Commerciales* in 1931. In 1940 he added Pierre Dagenais to the staff. All of these geographers were trained in departments of geography in universities in France before returning to teaching in Canada. Thus the influence of the French geographers, who were world leaders in the early part of this century, has been strong in the development of geography in Quebec.**

Geography expanded into the other faculties of the *Université de Montréal* after World War I. Courses were established in the *Faculté des Sciences Sociales* in 1921. The first professor was French-trained Emile Miller, who had written several books on physical and human geography. A promising career ended prematurely when he was drowned in 1926. Courses were continued by a famous visiting French professor, the human geographer Jean Brunhes, who gave lectures in 1925-27. Miller was succeeded by Y. Tessier-Lavigne, who carried on the administration of geography. It was during this period that two young Canadians were stimulated to continue graduate work in geography in France. They were Raymond Tanghe and Benoît Brouillette. The former returned to the *Université de Montréal* about 1929 as professor of human geography, and the latter went to the *École des Hautes Études Commerciales* in 1931. Geography at the *Université de Montréal* has been strengthened by annual visits (1929-38, 1945-49) from another noted French geographer, Raoul Blanchard. His three volumes on the geography of Quebec are standard reference works, and his influence as a teacher has been spread throughout the schools of Quebec by his students.

The University of British Columbia was the first Canadian university to give geography partial departmental status. When the university opened in 1915 a course in physical geography was offered by S. J. Schofield in the Department of Geology and Mineralogy. In 1920 the department introduced a course in meteorology and climatology, which has been taught continuously since that time. In 1922 the name of the department was changed to that of Geology and Geography. The course in principles of geography was presented by the head of the department, R. W. Brock. His wide travels and broad outlook meant that a course covering the general principles of

*This article is a condensation of part of the Presidential Address given by Prof. Robinson before the Association of Pacific Coast Geographers in Los Angeles, June 1951.

**The author is indebted to B. Brouillette for factual material describing the development of geography at the University of Montreal.

physical, human and economic geography was given to the students. In later years a few other geography courses, taught by one or more of the geologists on the staff (notably by H. V. Warren), were added to the departmental curriculum. By 1936 most of the courses were consolidated under N. F. G. Davis, who developed liaison with American geographers southward in the State of Washington.

Until 1935 geography in Canadian universities was taught essentially by geographers in Montreal and geologists in Vancouver. The exceptions were isolated courses, usually in economic or commercial geography, which were given in some years, notably at the University of Toronto, Queen's University, McMaster University, and the University of Western Ontario. At Toronto, for example, economic geography had been taught as early as 1906, and the work was expanded by the writing and research of Harold A. Innis in the early 1930's.

Pre-war and War Expansion

In 1935 the University of Toronto appointed to its teaching staff Dr. Griffith Taylor, who already had a notable record of achievement in geography at the University of Sydney, Australia, and at the University of Chicago; and in 1936 the first full Department of Geography in Canada was established under his direction. Next year Donald Putnam, from the Botany Department, joined the staff; and in 1939, George Tatham came from England to assist in teaching geography students. In 1940 an honours course in geography was established, and Toronto became the first university in Canada to begin serious training of geographers. Since there were no outlets in government service at that time, most of the students took geography as part of an Arts course and went back into the teaching field in secondary schools. In 1944 the first Ph.D. in geography was awarded to Chun-Fen Lee, and next year the second degree went to J. Wreford Watson, then at McMaster University. Neither of these men was a native-born Canadian.

The teaching of geography in Canada began to expand in the universities prior to World War II. In 1938 a geography lectureship was established in the Department of Geology at the University of Western Ontario. Courses were given by Edward G. Pleva, from the University of Minnesota. In 1939 McMaster University brought in British-trained J. Wreford Watson to expand the geography offerings of that university. At both Western and McMaster the subject soon became an established part of the General Arts curriculum, and enrollments in geography courses increased. At McMaster, in 1942, a separate Department of Geography was created, the second in Canada.

Post-war Expansion

World War II proved the value of geography training in many branches of the armed services and in various allied governments. It also drew attention to the lack of trained geographers in Canada, as compared with other countries. Awareness of this deficiency, in addition to the increasing emphasis upon "world understanding" and the need for more and better knowledge of the world and its peoples, was among the reasons for the encouragement of geography after World War II. New departments were established; old departments were expanded.

McGill University inaugurated a Geography Department in 1945, headed by George H. T. Kimble, who had lectured at the University College of Hull and Reading University, England, prior to the war. Courses were expanded with the addition in 1946 of F. Kenneth Hare from London, England, and J. Ross Mackay, a Canadian with American training in geography. During the summer of 1947 the unique McGill Summer School of Geography was opened at Stanstead, Quebec. This school brought in outstanding authorities, particularly from the United States and Great Britain, and strong emphasis was given to Arctic studies. In 1950 Kimble became Director of the American Geographical Society, New York, and Hare took over as Chairman of the Department of Geography at McGill.

Geography expanded at the *Université de Montréal* in 1945 when courses were given in the *Faculté des Lettres*. Finally, in 1947, a department was established under the

name of the "*Institut de Géographie*", headed by Pierre Dagenais. Thus the university which had been a leader in geography education fully recognized the position of the subject in the university organization. The staff included several guest lecturers from other faculties of the university and from McGill University. The Institute began granting the Ph.D. degree in geography for notable research and contributions to the field of geography. The first degrees were awarded to George H. T. Kimble, J. Ross Mackay and F. Kenneth Hare.

Geography had been taught at Laval University by Benoît Brouillette as guest professor for a few years prior to World War II. In 1947 *l'Institut d'Histoire et de Géographie* was established, but it was two years later before the courses were taken over by Pierre Biays, geographer from France. His appointment is a continuation of the liaison between geographers in Quebec and France.

Geographers who had been teaching prior to World War II added to their staffs and courses as university enrollments increased with the flood of returning veterans. At Toronto there were more than 1,000 geography enrollments in 1947-49. By this time Canadian-born geographers, some of whom had done graduate work in American universities, were becoming available for teaching appointments. L. Reeds and the late W. Draper were appointed in 1945, and D. Kerr and W. C. Wonders were added in 1947. Toronto thus maintained its leading position as having the largest Geography Department in Canada, both in teaching staff and numbers of honours and graduate students. In 1950 the department granted its third Ph.D. degree to D. Kerr, and in 1951 its fourth to W. C. Wonders. Several other candidates are completing dissertation work. Some years ago an autumn field-camp was established under the direction of Donald Putnam; this has recently become a joint enterprise of the geography departments at McMaster and Toronto, giving valuable field training to the students of both universities.

In June 1951, Griffith Taylor, the "dean of Canadian geography", retired. He could look back on the successful establishment of geography in Canadian universities—which was, in no small degree, due to the provocative stimulus of his numerous writings and public lectures.

Typical of the expansion in geography departments in Eastern Canada was the appointing to their staffs by McMaster and Western universities of young geographers trained during the war. In 1949, however, the vigorous department at McMaster lost its chief, J. Wreford Watson, who took over the important position of Director of the Geographical Branch in Ottawa. The department is being carried on by L. G. Reeds. At the University of Western Ontario an enrollment of 750 students in 1947 showed the importance of geography in the university curriculum, and it was given the status of a sub-department. In 1949 geography became a full department under Edward Pleva. Geography at Western has gained a leading place in regional planning developments and educational training in the area of southwestern Ontario where the department's energies have been concentrated.

Paralleling the expansion in Eastern Canada, the University of British Columbia began reorganizing its geography courses in the Department of Geology and Geography. In 1945 the first two geography-trained instructors were added — T. R. Weir and Mrs. G. O'Brien. In 1946 J. Lewis Robinson, formerly geographer for the Northwest Territories Administration, Ottawa, was appointed as Associate Professor to expand and reorganize geography courses. In 1947 the department added John Chapman from Oxford University. A third permanent appointment was made in 1949 with the addition of J. Ross Mackay, formerly at McGill. Geography was also added to the curriculum of Victoria College (affiliated with the University of British Columbia) in 1947. Lectures were given by the late D. Kirk.*

Some of the smaller universities have also begun to add geography to their curricula. In a few cases geographers have been given the responsibility of organizing and teaching the courses but frequently a single course is given by a member of some other depart-

*Dr. Kirk died in July 1950, in an aeroplane crash on northern Ellesmere Island.

ment. In 1949 the University of Manitoba appointed T. R. Weir in the Department of Political Economy. Ottawa University and Carleton College in Ottawa both have geographers teaching on a part-time basis. Other universities currently have committees meeting to arrange for the establishment of geography courses, and appointments will be made as soon as suitable candidates are found.

Among the large universities, geography departments are not found at Queen's, Alberta or Dalhousie. At Saskatchewan geography lectures are given by geologists; and at New Brunswick geography will be introduced in 1951 by an economist with partial geography training at the University of London. Many of the smaller universities and colleges cannot afford full-time specialists, and geography courses are given by various untrained (in geography) lecturers. Although the quality of this work will vary with the interest of the instructor, it is at least encouraging to see that an attempt is being made to present geography courses.

Geography enrollments have remained high at each of the leading universities, despite the gradual decline in total university enrollments since 1948. In 1949-50 there were over 800 geography enrollments at each of Toronto, Western Ontario and British Columbia universities. Graduate students were becoming more numerous, and were placing a heavy load on the teaching staffs, already overworked with large undergraduate classes, and having, in general, poor teaching equipment and facilities. Toronto and McGill were handling the largest graduate groups, with twenty-five and thirty-three respectively registered in 1950. The other universities giving graduate work were: University of British Columbia, Western Ontario, Montreal and McMaster. This expansion in graduate work is the most notable advance in recent years. It is no longer necessary for young Canadians to go to American universities for post-graduate training in geography.

Geography has progressed a long way in Canadian universities in the past decade. In most cases the requests for new courses and expansion have come from administrative officers who realized the need for geography courses in a general education program. Geography has fulfilled these expectations, as indicated by student interest and general acceptance by other university departments. There still remains the problem of placing geographers in the small universities to take over the courses now being given by non-geographers.

The time has come for consolidation and stock-taking. Each department has grown up separately, more or less involved in its own problems of organization and curriculum-building in the light of the local university pattern. Often there has not been time for consultation and comparison with developments at other universities. As a result there are differences in course contents, prerequisite standards, and graduate training. Some of these difficulties are born in the local university regulations regarding honours and graduate work, but others are due to lack of staff and facilities within the geography departments.

Geography is now established in Canada. The founding of the Canadian Association of Geographers, which held its first meeting in Montreal in May 1951, along with other learned societies, is a sign of the maturity of the subject and the number of adherents. It is time for geographers to stop and survey their progress and their failures. They believe that the subject is important in general education, and that it is a profession which can contribute to government, business and industry. The future will be brighter if Canadian geographers can co-operate in proving the soundness of their convictions.

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EDITOR'S NOTE-BOOK

B. J. McGuire edited the daily publication *The Varsity* while he was at the University of Toronto. After graduating he was employed for some time in newspaper work before he joined the staff of The Aluminum Company of Canada. For several years he was occupied with public relations work for that company in Toronto, Kingston and Montreal. Mr. McGuire is now a director of Public and Industrial Relations Limited and much of his writing is of an educational nature.

* * *

E. W. Pitt was born and educated in Birmingham, England. After training in architectural history, drawing and design he spent some years studying buildings of architectural and historical importance. He did valuable work in connection with the surveying and recording of numerous buildings of aesthetic merit in England and the Near East. Mr. Pitt is particularly interested in archaeology and topographical art; he is represented in the Pilgrim Trust Recording-of-Britain Scheme by water-colour sketches of East London.

* * *

Eva Bradford Beckett was born at Lachute and is a graduate of Lachute Academy and MacDonald College, Quebec. For many years Mrs. Beckett has lived during the summer at Churchill, Manitoba, where she has made a special study of the birds and wild flowers. She has published many articles, illustrated by her own photographs, on the natural history of the Churchill district.

* * *

J. Lewis Robinson is one of the new school of geographers that he describes in his article in this issue. His educational training was at the universities of Western Ontario, Syracuse, and Clark. He was one of the first native-born Canadians, outside of Quebec to receive his doctorate degree in geography. Dr. Robinson was the first geographer to be employed by the Canadian Government, his work involving problems of development in Northern Canada. Since 1946 Professor Robinson has been in charge of geography courses at the University of British Columbia. In 1949 he was elected Vice-President of the Association of Pacific Coast Geographers and he was recently elected Vice-President of the newly formed Canadian Association of Geographers.

* * *

AMONGST THE NEW BOOKS

Wessex

by Ralph Dutton

(B. T. Batsford, Limited, London; Clarke, Irwin & Company, Toronto, $2.50)

One of the Batsford "Face of Britain" series of uniform volumes, *Wessex* treats a region rather than any specific county of England. In this book Mr. Dutton covers Dorset, Wiltshire and Hampshire, together with West Berkshire and East Somerset—that central section of southern England which is neither southeast nor southwest. The author begins by giving a brief history of this ancient kingdom prior to, during and since the Roman occupation. The huge chalk figures cut out of the gently rising hillsides, the "Celtic" terraced fields, the prehistoric earthworks and the mysterious monoliths (of which Stonehenge, while not the largest, is best known because of its dramatic site on the border of Salisbury Plain), are all dealt with in some detail both in text and illustrations.

Mr. Dutton, who was born and still lives in Hampshire, has an intimate knowledge of the whole of Wessex, and deals lovingly with its villages, its cathedrals, mansions and other fine old architectural triumphs. He deals harshly, however, with the Victorians who were guilty of bringing architectural calamity to many villages. The author also deplores the disfiguration of much of Salisbury Plain, made necessary by the demands of civilization and war.

Wessex has something of interest for almost everyone, because Mr. Dutton has done a scholarly job of re-

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* * *

Florida Today

by A. Lowell Hunt

(Charles Scribner's Sons, New York; S. J. Reginald Saunders, Toronto, $4.75)

This is a handsomely printed and illustrated guidebook to Florida designed not only to provide information about that state, but to convince the reader that it is a delightful place to visit or to live in. In addition

(*Continued on page X*)

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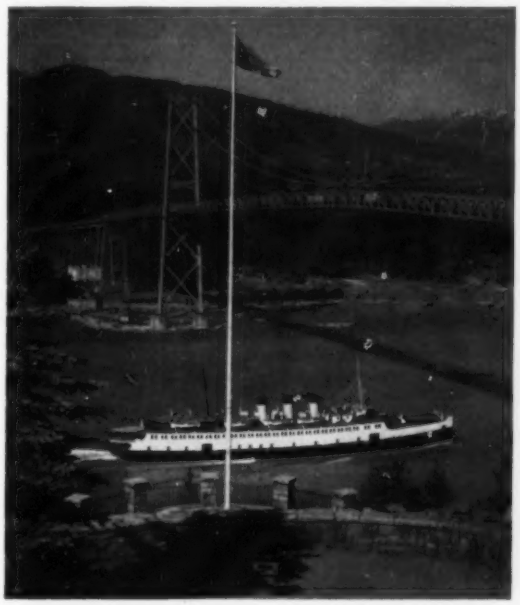

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* An actual incident taken from our files.

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(*Continued from page VIII*)

to descriptions and photographs of the region itself, its beaches, its cities, towns, farms, groves and swamps, it contains information about costs of living, jobs for would-be residents, facts about the climate, taxes, and business opportunities, and full descriptions of agricultural, fishery and industrial resources of the state.

Mr. Hunt has obviously spent many years moving about every part of Florida, and has culled his facts from authentic sources to provide an answer to practically every question ever raised about a fascinating region. His answers correct a lot of misconceptions held by those who think of Florida only in terms of Miami Beach or St. Petersburg. JAMES KINLOCH

* * *

The World — A General Geography

North American Edition

by L. Dudley Stamp and G. H. T. Kimble

(Longmans, Green & Co., Toronto, 1950. $2.50)

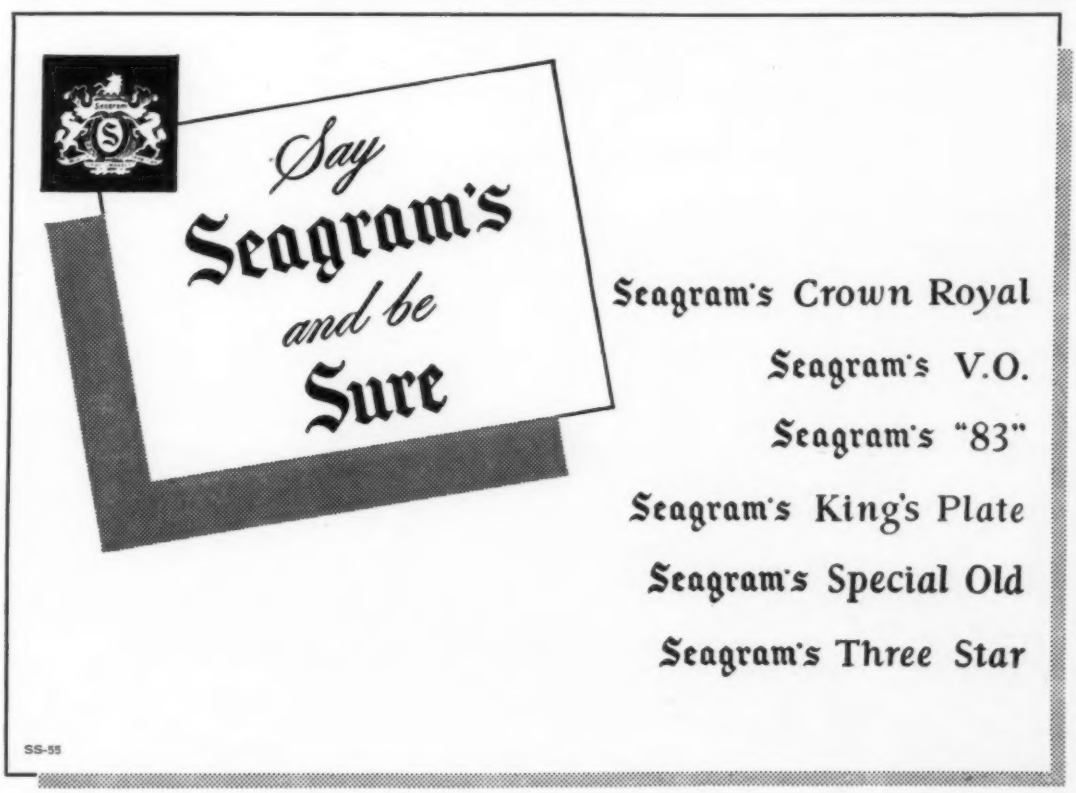
This school textbook, written by two of the foremost geographers of the English-speaking world, may well find profitable use on the bookshelves of many a home. The text has been considerably expanded and rewritten in this new North American edition, and as a handy reference on geographical fact it belongs on the same shelf as a good standard atlas.

The World covers the entire field of geographical enquiry, combining both systematic and regional approaches. The first part of the book is devoted to sections covering weather and climate, the shape and size of the earth, the cycles of mountain-building and erosion, and the elements of map projection and map reading. Then follow the sections dealing with the geography of the earth's major regions: in this edition more emphasis is laid on North America than on any other continent.

The text is profusely illustrated with maps, diagrams, and a number of photographs, many of which are the work of the authors themselves. While not as handsomely printed and bound as some of its American counterparts, the type is large and easy to read, and the content is as complete as could possibly be expected in a book of its class.

Whether this book will ever be as useful to Canadian schoolchildren as it will be to their parents, is a point that may well be debated by school authorities across the Dominion. The clear and simple language of the text seems, at many points, to mask the difficulty of the underlying concepts.

There is but limited space in a book of this scope, for entering into detailed discussion and example of many of the facts and principles set forth. The background must needs be filled in by the teacher, but with the present lack of trained teachers of geography in Canada, most pupils must do without any extra help. This is not a fault of the book, but it does, in this reviewer's opinion, limit its usefulness mostly to readers of more mature minds than the schoolchildren for whom it is intended. H.N.L.



Geographical Bulletin

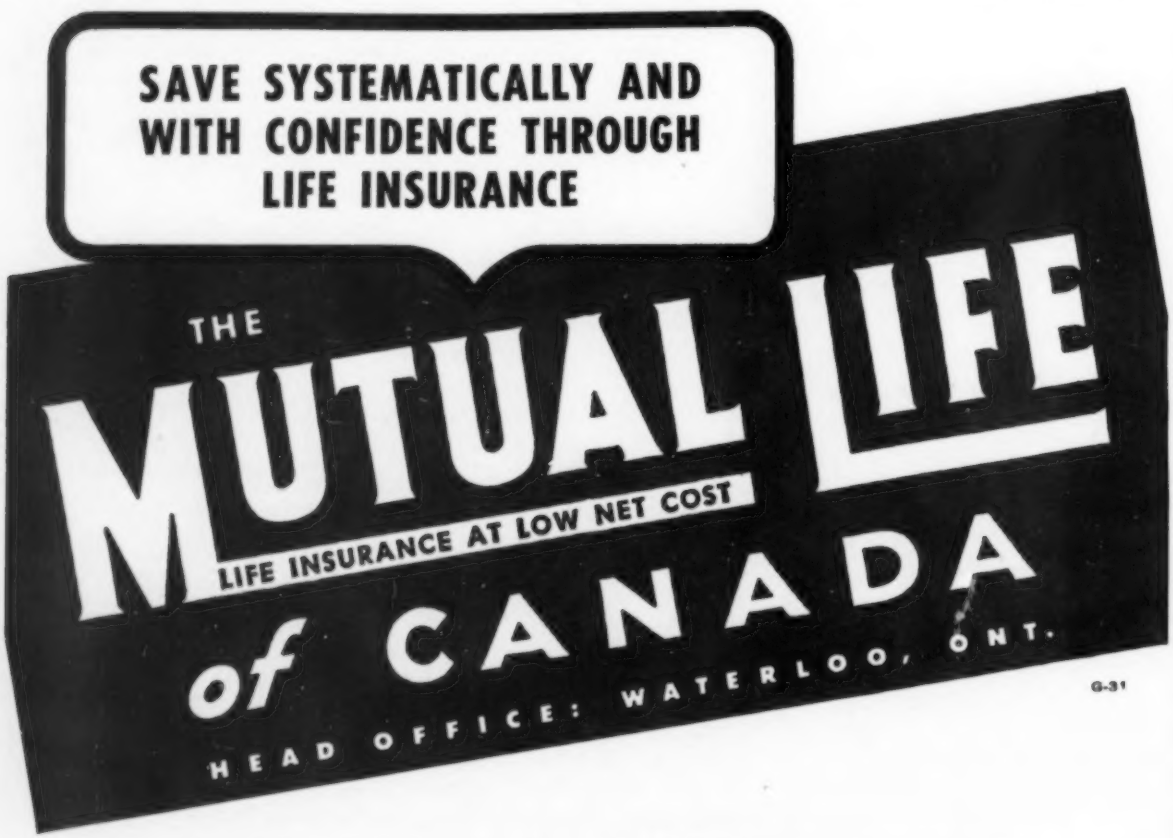
(King's Printer, Ottawa; twice yearly, 50c. a copy)
(Obtainable from The Director, Geographical Branch, Dept. of Mines and Technical Surveys, Ottawa)

It is a very great pleasure to report the appearance of a new Canadian publication on geography—the first number of the *Geographical Bulletin* issued by the Geographical Branch of the Department of Mines and Technical Surveys. This Branch was originally established as a Bureau of the former Department of Mines and Resources in June, 1947. Its duties are to collect and classify all the information available regarding the geography of Canada, and also to assemble maps and facts about other countries. Its activities include both studies in the field and compilations in the office. One of its current major projects is the assembling of material for the production of a new national atlas of Canada. In addition to the Bulletin which will continue to describe the progress of work in the Branch, it is expected that memoirs on special subjects will also be published.

Bulletin No. 1, with 91 pages, contains four articles on Canada of which three are in English and one in French. At the end of each of the three former is a summary in French and at the end of the article in French, a summary in English. The volume includes a preface by Dr. J. Wreford Watson, Director of the Branch, and map notes and book notes regarding recent maps and reports of geographical interest published by government departments in Canada.

The first article, "The Establishment of Settlement Patterns in the Ausable Watershed, Ontario", by Norman L. Nicholson, gives an interesting account of the stages of the settlement in the area at the south-eastern end of Lake Huron from the days of the Indians to the present.

The second paper is "The Physiography of the Middle and Lower Thelon Basin" by John B. Bird. Though explorers such as J. B. Tyrell, J. W. Tyrell, Handbury, and others have travelled and given descriptions of the main canoe routes, much of the area described in the paper, particularly that north of the Thelon, has never been visited by scientists and until last season had not even been seen from the air. Mr. Bird discusses the geology of the region, the effects of the Pleistocene continental glaciation and the weathering results which have taken place since the disappearance of the ice. The evidence of ice movements in the Thelon Basin supports the view of R. F. Flint for a Hudson Bay origin for the ice. On the basis of the topography and the stage of physiographic development, the area under discussion is divided into five regions: (1) The ridge and valley region south of Aberdeen and Schultz Lakes; (2) The sandy till plain of the middle Thelon Basin;



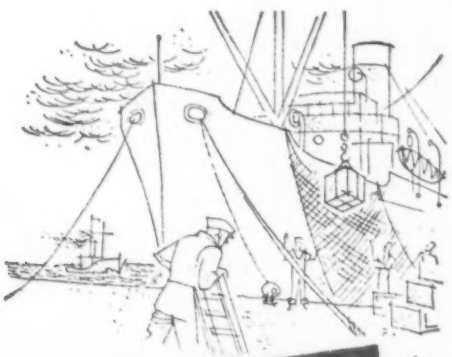
(3) The Sandy till uplands; (4) The Central Keewatin plateau; (5) The Mallery Lake lowland.

"Le Port et l'Arrière-pays de Trois Rivières" by Pierre Camu, concerns the fifth harbour of Canada, whose traffic now averages over 2,000,000 tons yearly. The hinterland of the port is the valley of the St. Maurice River whose industrial development has been due to the hydro-electric power potentialities and to the extensive woodpulp reserves. The part that the harbour plays in the economy of this region is dealt with in detail.

"Pedogeography of Canada" by Donald F. Putnam discusses the importance of soil studies and the progress made in this connection in Canada to date. Canada is divided into large zones according to the types of soil, the plant associations, climate and utilization.

The Bulletin is attractively illustrated with maps, diagrams and figures. Future numbers will be looked forward to with interest.

F. J. Alcock



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